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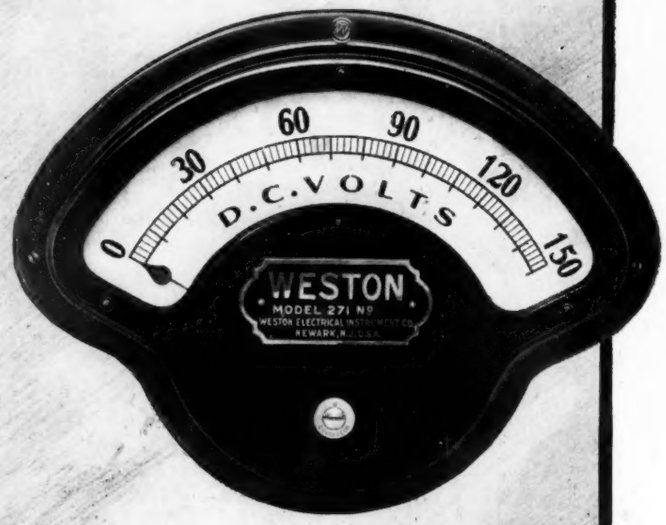

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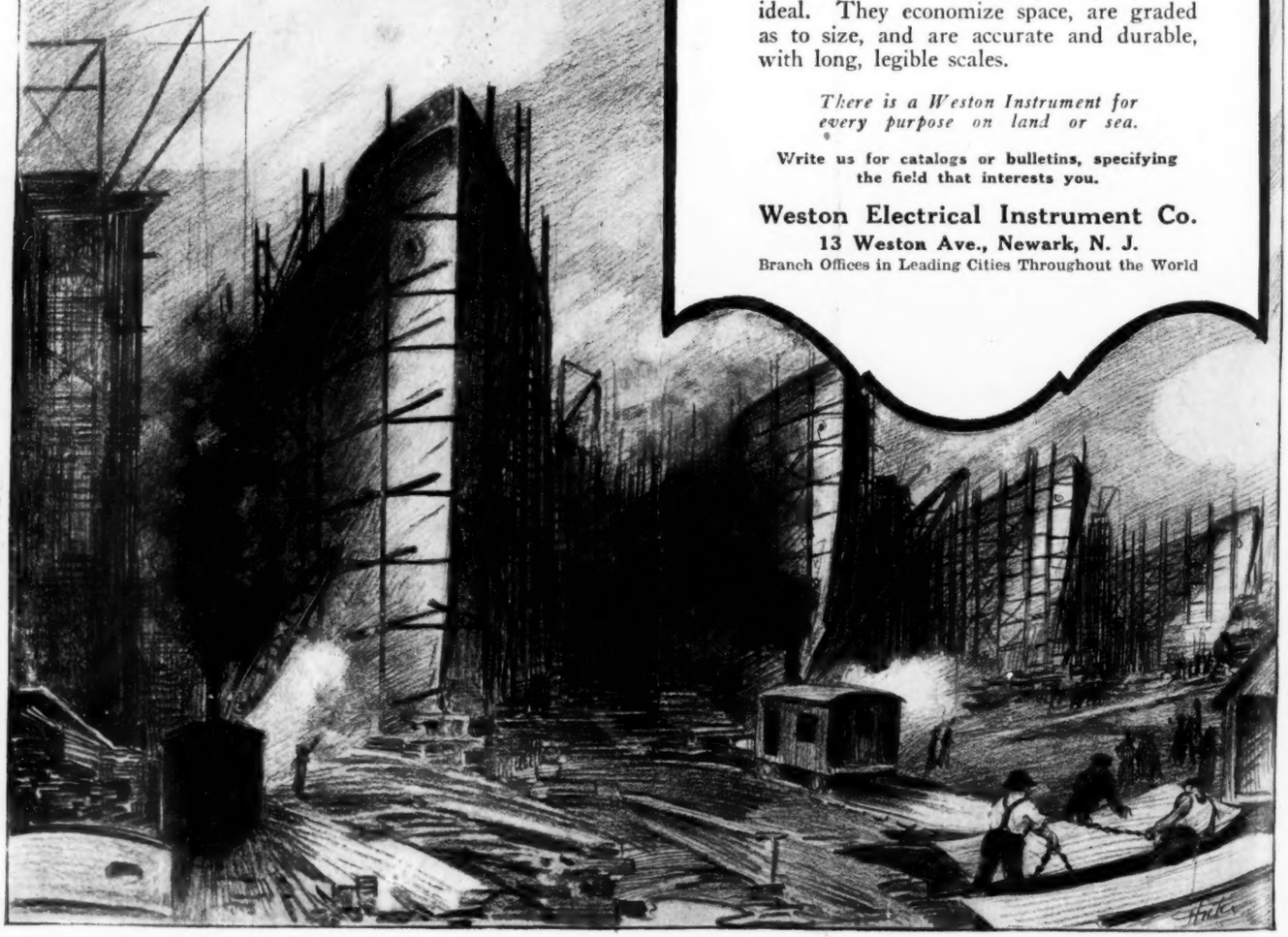


Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 74 New York, Saturday, September 13, 1919 *Number* 11

The Export Trade Opportunity

SEVERAL important considerations should be taken into account in measuring the present prospects of foreign trade for electrical manufacturers of this country. The industry is not thoroughly organized for handling and developing the export competition and business of the post-war period. There is no assurance that it will ever be knit together in the sense in which our European competitors are likely to be organized nation by nation, backed by government power and sympathy. The industry cannot look much further for results than what its own efforts will yield. The national government's attitude affecting export trade is one that our manufacturers have accepted in the past without alarm. They felt serene in their ability to do such export trade as it suited them to do, and they did not worry much over foreign orders that they failed to get. It is greatly to be doubted, however, whether they will hold to the same easy tolerance in the future. The world is alive with commercial opportunity, Europe hungers for markets, and there will be a keenness in competition which will challenge manufacturers to record production and low cost. Fortunately, the industry has a tradition, a genius in invention, a high quality of manufacturing standard, a power in organization which give it great advantage.

The present situation in the electrical export trade in this country is that the largest manufacturers, having previously developed extensive departments or subsidiary companies for handling this business, are now strengthening them. They are, of course, perfectly able to build up whatever organizations, in form or extent, appear to promise largest results in future. They have the necessary financial resources; they have knowledge of markets, methods and available men. They have already secured a high reputation in world markets for the quality and performance of American electrical products. They know what character of competition was met from Europe in the past and they can form a reasonably good notion of what will be found when trade relations are again following more normal lines. It is no secret that the large manufacturers, operating as separate units, have been actively sounding all the possibilities. In general, it may be stated from what is publicly well known of their activities that they feel that the outlook justifies extensive preparation. Certainly, if their conclusion had been otherwise they would not have taken the steps which are paving the way to a permanently larger production of apparatus and supplies in our factories for consumption abroad.

Now the same opportunities to serve foreign consumers which are open to the large manufacturers are open also to the small manufacturers. There should be an organization among the smaller manufacturers to conduct foreign trade which would be really comparable with the progress of the larger manufacturing companies in the industry. One group of non-competitive manufacturers has, in fact, united for export purposes in an association with a selling agent. It is clear that many of the smaller manufacturers are fully awake to the possibilities. They can turn freely to the form of combination permitted by the Webb-Pomerene law if they desire. This law permits wide latitude and both steel manufacturers and copper producers have united under the authority of its provisions. From all of the developments affecting export conditions in the wide world it appears to be highly desirable that the smaller manufacturers shall take some early steps which will assist them in getting and maintaining a firmer foothold abroad. A small beginning is better than none.

It is a just cause of pride with the Hartford Electric Light Company that no war work in that busy Connecticut city was delayed a single minute on account of a shortage of power. We may be sure that this was not a case of pure luck. Eternal vigilance was the price.

Non-Abusable Electrical Apparatus

FOR several years past the engineers in steel mills and in other similar industrial establishments have used the word "rugged" freely in specifications and articles. But anything "rugged" costs money, and there is no limit to abuse, especially where carelessness of an operator is not altogether a result of technical ignorance. A master controller is the principal and perhaps the only piece of apparatus with which a non-electrical worker in a steel mill comes in contact, and it is mainly through the master controller that he can do damage to machinery, cables, magnetic switches, etc. This fact has been lately realized by steel-mill electrical engineers, and current-limiting relays have been included in the more recent installations. In starting a motor the first contactor is closed instantly with all the resistance in series, but it is impossible to close the second contactor until the current has dropped to a certain predetermined limit. The same applies to the rest of the contactors, which gradually cut out the starting resistance. Thus the motor is started in the most efficient and the quickest way, at its maximum permissible current, and nothing is left to the operator's judgment. In this way production is increased and repairs are saved on the electrical apparatus. Moreover, the motors and the switches do not have to be built with an indefinite margin of safety. The setting of the current and time-limit relays in itself determines the possible overload.

Rectifying High-Tension Alternating Currents

IN THE day of Franklin it was possible to obtain high-tension unidirectional electricity by means of the frictional machine, although the voltage of delivery was very unsteady. It was impossible to secure alternating electricity of any tension. At the present time conditions have become reversed. It is possible to obtain alternating voltages up to a million volts if necessary, whereas it is relatively difficult to produce high-tension unidirectional currents.

Some interesting experiments with a point-plate high-tension rectifier are described in this number by Samuel Cohen. Owing to the dissymmetry of spark-gap electrodes, an electric current can flow much more easily in one direction than in the other when the spark gap included in the circuit has a point on one side and a plate on the other. Consequently an alternating emf. supplied to the circuit tends to produce a rectified unidirectional current. This rectifying tendency has not been available for any important service owing to the inefficiency of the spark gap under ordinary conditions in air.

The article states, however, that in other gases, particularly in ammonia, and with the aid of an increased hydrostatic pressure, the rectification becomes stabilized as well as improved in efficiency.

The commutator cannot be employed to rectify alternating currents above a certain limit of voltage because of its arc-over properties. It would be remarkable if the arc between dissymmetrical electrodes were to replace the commutator as a high-tension rectifying device.

More public good will is made or lost at the counters where central-station patrons make applications for service and pay bills than at any other point of public contact. Too many of the clerks at these counters give twelve-hundred-dollar courtesy to the man who pays a twelve-hundred-dollar bill and fifty-cent courtesy to the man who pays the minimum. Official attention to education of clerks can change this.

Synchronous Condensers in High-Tension Systems

THE synchronous motor operating as a condenser is a valuable adjunct to a power-transmission system. When installed without mechanical load it takes a certain amount of active power to keep it running, say 5 per cent of its motor rating. Then, by merely varying the field excitation it will deliver to the system as a generator reactive power either inductive or condensive as may be desired. In practice it is generally used to furnish reactive power condensively; *i.e.*, to act as a condenser.

Synchronous condensers may be used either to improve the voltage regulation or to improve the power-factor regulation. It is possible by their aid to operate either a single line or a closed loop of line with various stations on the loop, some generating and others consuming power, but all working at the same three-phase line voltage. Such a condition is impossible in direct-current transmission and would likewise be impossible in alternating-current transmission without the assistance of either static or synchronous condensers. the assistance of either static or synchronous condensers.

condensers in a Californian power system is contributed this week by J. W. Andree. In this case a long 150-kv. transmission line has its pressure held constant at both ends up to 30,000 kw. of load with the aid of synchronous condensers.

The article also shows that the static capacitance of the transmission lines may also be utilized for regulating the voltage over a transmission system. Fig. 1 is particularly interesting in this respect.

Under government ownership, individual responsibility takes refuge in a federal, state or municipal alibi; indirect action takes the place of direct procedure, and initiative yields too often to bureaucratic complacency. It follows that the quality of service sags below the standards of progressive administration and that the cost of such facilities is generally excessive, waste and extravagance and inefficiency being effectually concealed within the all-embracing tax levy.

Locating Defective Line Insulators

THE improvements which steadily enter into the construction of power-station machinery tend to make the power-transmission line the weakest point in the system and the place where breakdowns are most likely to occur. This condition is the most acute in the systems of highest electrical pressure.

In order to improve the line construction and to bring it into equality of strength with the rest of the system, the recent tendency has been to use stronger and better designed towers for the support of important transmission lines and to give increased attention to the insulators. The insulators of high-tension lines have not only to be carefully selected and installed, but they have also to be inspected and tested at suitable intervals.

There are two kinds of tests for insulators, or strings of insulators, on transmission lines, namely, those which require the insulator to be disconnected from the working line and those which can be made while the insulators are in service on the working line. A very simple method of the latter kind is described by T. F. Johnson, Jr., in an article beginning on page 568 of this number. In a certain sense it requires no electrical apparatus. It uses what may be described as a pike or a staff with a metallic point, and also a shorting rod, or a staff terminating in a metallic fork. By touching the pike to the caps of successive insulators in a string and then drawing the pike off, characteristic spark sounds are produced which an experienced operator can interpret as indicating a satisfactory or defective condition of each unit in the string. The forked staff, or shorting stick, can be used to corroborate the indications of the pike or feeling-out stick.

Some of the details of the tests as described are of especial electrical interest. Thus it is pointed out that when a string of insulators supports a high-tension wire beneath a cross-arm the one which gives the minimum buzz spark in feeling out and also the minimum jump spark in shorting out is generally the next but one to the cross-arm. Presumably the shortest and quietest spark would be at the insulator immediately below the cross-arm if the arm were replaced by a long thin vertical metallic rod. The fact that it is the insulator next beneath which actually gives the least spark may be

on account of the relatively large metallic surface offered by the cross-arm, which increases the virtual capacitance of the first insulator next to it. It would be interesting to know whether this is a correct explanation.

Allocation of operating costs and fixed charges to particular services in large central stations should be made less difficult by a closer coördination between accounting and engineering departments. In this way assumptions can be reduced to the minimum or at least established within limits which are workable. A long step forward is always taken when the reasonable range of computations is settled, and the engineer can help the accountant to realize concrete conclusions through the proper installation measuring equipment and expert interpretation of technical data.

Safe Temperatures with Mica Insulation

IN THE early forms of dynamo machines, cotton insulation was almost exclusively used around the conductors. That is to say, the insulating material was cotton cellulose. Such material is known to undergo decomposition at temperatures near to that of boiling water. When the working temperature of the wires much exceeded 100 deg. C., the decomposition and carbonization of the material tended to proceed at a relatively rapid rate. Frequent breakdowns accompanied such overthermal loads.

The experience of the last thirty years, in the works of the large dynamo building companies, has led to great improvements in the art of dynamo insulation. It has come to be recognized that each type of insulating material, of standard quality, has a certain limiting temperature which it can safely withstand. If the temperature in an armature winding nowhere exceeds this limit, the insulation can be depended upon after good construction. Unfortunately, in the interior of a winding, and especially at points difficult of access with the thermometer, hot-spot temperature elevations may occur considerably in excess of those revealed by thermometer near the surface or likely to be estimated from the mean-temperature revelations of winding resistances.

A great step forward was taken when thermo-couples and compact resistors were inserted in the internal portions of large and important armatures, so brought out and connected that the switchboard attendant could ascertain at any time the actual internal temperatures at or close to the hottest spots of the winding and its insulation. He was thus enabled to know just what margin of capacity he had available in his machine for carrying needed load.

Another great step was taken in the development of high-temperature insulating materials, like mica. The experience with such materials has shown that much higher temperatures can safely be carried in the armature winding than would have been possible under the old régime.

A United Industry

NEVER did the electrical industry face larger opportunities for service. The war brought a great development in applied electricity which is proving only the foundation for further growth. The war has not only made possible unusual developments in the industry, but in facing the war problems sectionalism was forgotten and East and West met in the spirit of common good. The war is over, but the industry still faces problems in common and men in one section of the country meet with others to find their solution.

Owing to the unusual climatic and geographical conditions, the great America beyond the Rockies was before the war isolated in thinking and in action. Remarkable engineering and commercial development has taken place there and a great section of the industry has grown up in which the men of the Pacific Coast have done pioneer thinking and have met and solved new problems. The local problems of the Coast still exist, but this year as never before they have become a part of the national thinking of the industry. East and West have come to see that each can learn much from the other. The president of one of our great electrical organizations and the chairman of its public policy committee are Pacific Coast men.

Two of the most important conventions, those of the National Electric Light Association and the Electrical Supply Jobbers' Association, are already scheduled for the Coast. This year marks the beginning of an industry presenting a united front to its problems. Sectional problems exist, but they exist as part of the national development.

It is with an especial sense of fitness, therefore, that the publishers announce that the *Journal of Electricity* of San Francisco has become affiliated with the ELECTRICAL WORLD and *Electrical Merchandising*. The editor of the *Journal of Electricity*, Robert Sibley, formerly professor of mechanical engineering at the University of California and professor of electrical engineering at the University of Montana, has become Pacific Coast editor of the ELECTRICAL WORLD and *Electrical Merchandising*.

The *Journal of Electricity* will continue to specialize in the editorial treatment of the detailed problems of what has been called the "Far West," in engineering, in power development and sales and in merchandising development, under the different geographical and trade conditions which will continue to demand this specialized treatment. The ELECTRICAL WORLD will present to the industry as a whole those problems in whose solution the whole industry must take part, in public relations, in engineering, in general commercial policies. To the readers of the West, in turn, the ELECTRICAL WORLD will bring the best of the Eastern practice of engineers, central-station men and manufacturers.

Electrical Merchandising also will continue to serve its field nationally, promoting interchange of methods and principles in the field of selling, bringing to readers on the Coast the best ideas of manufacturers, jobbers, dealers and contractors in the East, and promoting nationally the spirit of practical coöperation of which the West has so well shown the value.

This coördination of electrical and publishing activities will enable the three publications both to broaden and to deepen their helpfulness to their readers. It means bringing East and West into closer contact than ever before. It means more intimate presentation to the country as a whole of the problems and conditions peculiar to the Pacific Coast. It provides a means for most effectively serving local needs on the Coast. Through this better understanding between the East and West which the affiliation of the three papers is designed to promote the industry will be able to present a united front to the engineering and trade problems of reconstruction which are occupying the minds of its thinking men.

Synchronous Condensers in High-Tension System

52,500 Kva. of Synchronous Condenser Capacity Is Used for the Extensive High-Tension System of the Southern California Company—Functions of Condensers Discussed—How Equipment Is Operated for Maximum Economy

BY J. W. ANDREE

Assistant Superintendent Department of Generation Southern Division, Southern California Edison Company

SYNCHRONOUS condensers are installed on electric transmission systems for three economic reasons: First, for reducing transmission losses by correcting for low power factor on the transmission lines; second, for voltage regulation at the receiving end of long transmission lines, and, third, for reducing the kva. load on generating equipment. The advisability of installing synchronous condensers, the finding of the proper location on a transmission system where they will be of the greatest advantage and the determination of the proper size of condenser to be used are problems requiring considerable study for proper solution. It is the present purpose to show how these problems were met by the Southern California Edison Company.

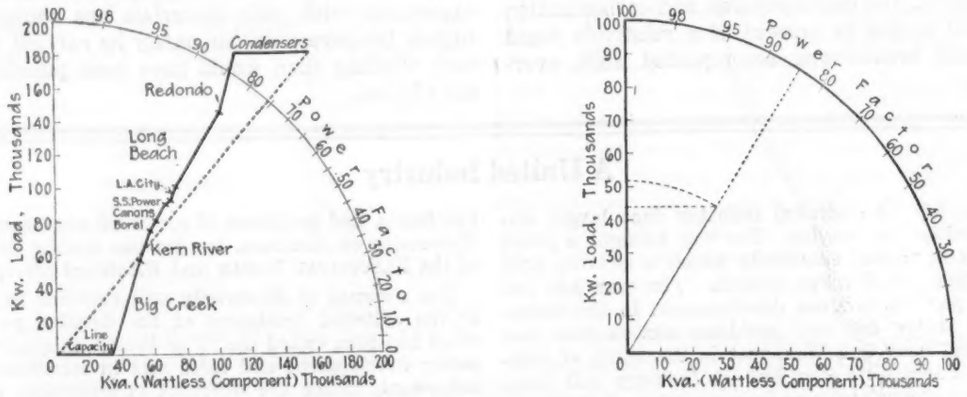
Synchronous condensers are indispensable for voltage regulation at the receiving end of long high-voltage transmission lines having large electric capacity. A good illustration of this fact is given in the operation of the Big Creek line of this company. This is a two-circuit line, 241 miles (388 km.) in length, and is operated at 150,000 volts. The conductors are stranded aluminum cable wound on a stranded steel core, the total cross-sectional area being 683,500 circ. mils. At the Big Creek power houses there are four 17,500-kva. generators, and at the receiving end, the Eagle Rock substation, there are two 15,000-kva. condensers for voltage regulation.

The inherent regulation of these lines alone, without terminal equipment, is indicated by the change from 10 per cent above power-house voltage at no load to 20 per cent below at full load. The electric capacity of the lines is 21,500 kva. with normal voltage at receiving end. By aid of the condensers the voltage at both ends of these lines is held constant at 150,000 volts up to about 30,000 kw. load, after which the voltage at the generating end is increased from 6 to 11 per cent at full load, depending upon the amount of single-line operation being done. There is usually a portion of one of the lines being used on other systems or out of service for repairs, tests, etc.

ALTERNATIVE METHODS OF VOLTAGE CONTROL

The advisability of using synchronous condensers on long transmission lines whose electric capacity is not large but upon which voltage regulation is poor because of the high resistance of the line is not so apparent. Here there are other alternatives which should be considered. Potential regulators may be installed at the receiving end to regulate the voltage. The particular advantages of these are that they may be obtained in small sizes to meet requirements of the load, that the first cost is low and that they require very little attendance. The disadvantages are that they load up the transmission line, which is already overloaded, with lagging current which must be supplied and transmitted from generators or condensers installed at other parts of the system. Other ways to overcome poor regulation on lines of this kind is to increase the current-carrying capacity of the line by increasing the size of the conductors or to decrease the current required for the given load by increasing the voltage on the line The objection to increasing the size of conductors as a means of correcting for poor regulation is the first cost and fixed charges. In the case of increased potential we have increased cost for transformers, insulators and line materials and also increased operating costs because of the greater number of failures in insulators and apparatus.

The advantages of using a condenser in this case are better voltage regulation, decreased line loss and decreased kva. load on generating equipment, transformers and lines. The objections are the high first cost and the increased operating attendance. The cost in each of these cases must be considered in conjunction with the probable load increase on the line and the capacity of



FIGS. 1 AND 2—POWER-FACTOR DIAGRAM OF WHOLE SYSTEM, AND WATTLESS KVA. FURNISHED BY LONG BEACH STEAM PLANT

Fig. 1 shows how total of 76 per cent power factor is carried. Fig. 2—27,500 kva. furnished at the expense of 7800-kva. station capacity

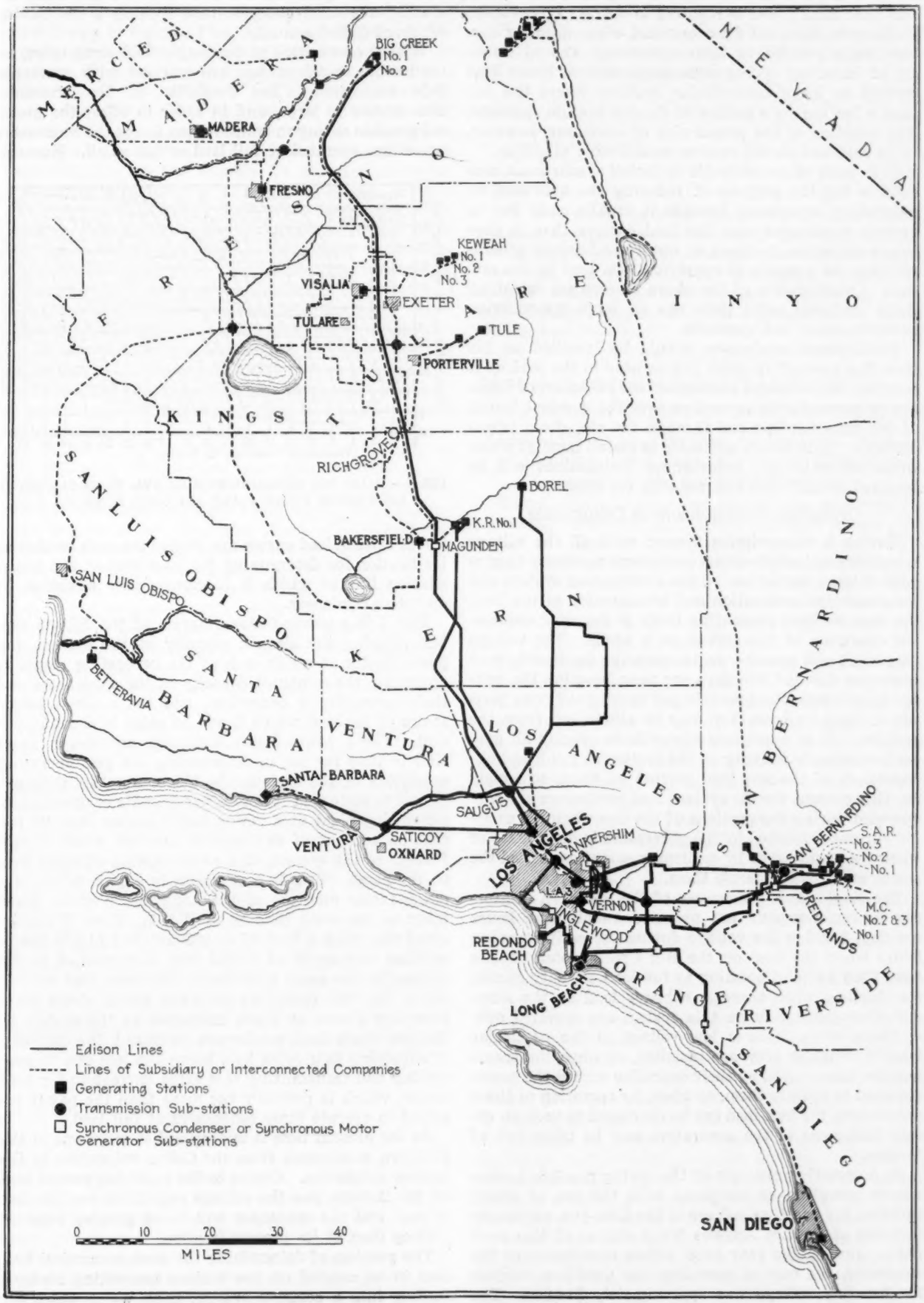


FIG. 3—MAP OF SOUTHERN CALIFORNIA EDISON COMPANY SYSTEM

and the load carried on the generating equipment. The fact that some power is required to operate synchronous condensers must not be overlooked when figuring savings made possible by their operation. The advisability of installing synchronous condensers at heavy load centers on large transmission systems where the voltage is low during a portion of the day is quite apparent. The selection of the proper size of condenser, however, to be installed should receive considerable attention.

It is quite often advisable to install synchronous condensers for the purpose of reducing the kva. load on generating equipment, because it usually costs less to operate condensers near the load centers than it does to operate steam turbines or waterwheel-driven generators for the purpose of supplying kva. load to the system. Combinations of the above reasons for installing these machines make their use on large transmission systems almost indispensable.

Synchronous condensers should be installed as far from the generating plant and as near to the load as is possible, thus taking advantage of the reduction of losses due to power-factor correction over the greatest length of transmission line and through the step-down transformers. It is always advisable to install them at places where no additional transformer installations will be required for full-load kva. capacity for them.

Operation of Synchronous Condensers

Having a transmission system with all the voltage regulators and synchronous condensers necessary to give good voltage regulation on the distribution system and for economical generation and transmission of the load, the next problem presenting itself is the most economical operation of the system as a whole. The voltage regulators will probably be in operation for twenty-four hours per day and 365 days per year, boosting the voltage during heavy load periods and bucking it during periods of light load, so they may be eliminated from the problem. It is sometimes advisable to operate all generators actually running on the system at full-load kva., regardless of the kw. load carried on them, to supply exciting current for the system, and condensers are only operated during the portions of the day when the exciting current furnished by the generators is inadequate or when the losses saved by condenser operation exceed the power required to operate them.

The Eagle Rock condensers of the Southern California Edison Company are operated twenty-four hours per day, bucking the voltage during the early morning hours when the load on the Big Creek system is less than 6000 kw. and boosting to full-load capacity during the daytime when there is a heavy load on the lines. All other condensers on this system are operated only at times when there is low voltage in the particular locality in which they are installed, or when the transmission losses saved by their operation exceed the power required to operate them, or when, by operation of these condensers, the kva. load can be decreased to such an extent that some of the generators may be taken out of service.

An interesting example of the saving possible in condenser operation as compared with the use of steam turbines for boosting voltage is the 6000-kva. condenser installed at the Los Angeles No. 3 station of this company. During the year 1913, before installation of the condenser, the cost of operating the 6000-kva. turbine for boosting voltage was approximately $14,000. The installation and operation of the 6000-kva. condenser reduced the operating expense to $8,000 per year, including the fixed charges, thus making a net saving of about $6,000 annually.

With the exception of the Eagle Rock condensers, no condensers on the system are operated with automatic field regulation. The flexibility of the transmission system is large, and in order to effect the greatest possible saving in transmission losses the condensers are either operated at full load or not at all. Economical or critical load curves are plotted for each condenser installation for determining the least load on the transmission line at which it is economically advisable to operate a condenser.

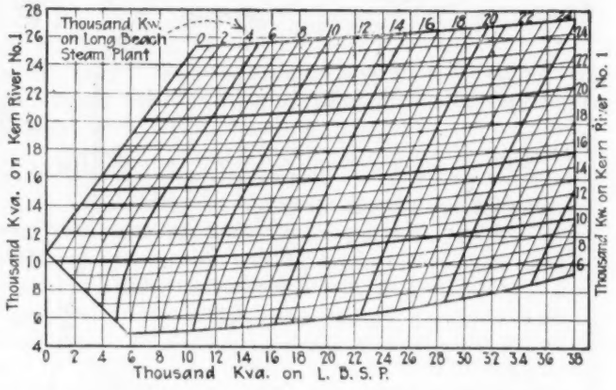


FIG. 4—CHART FOR DETERMINATION OF KVA. TO BE CARRIED BY LONG BEACH STEAM PLANT AND KERN RIVER NO. 1

Fig. 1 is a power-factor diagram of the Edison system showing the electric capacity of the system, the power factor at which each of the generating plants is operating, the combined capacity of the condensers and their power-factor correction, and the average power factor of the load, which it will be noted is about 76 per cent. These power-factor diagrams are drawn from time to time for use in determining the best operating conditions of the system. In this connection it might be well to state that it is seldom advisable to operate any generating plant at a power factor higher than 95 per cent on account of the exciting current which it will furnish to the system, at a small expense of extra kva. on the plant. This is best shown in Fig. 2, which is a power-factor diagram of the Long Beach steam plant taken at the same time as in Fig. 1. Here it will be noted that with a load of 44,000 kw. and 51,800 kva. a wattless component of 27,500 kva. is furnished to the system by the small increase of 7800-kva. load on this plant. By this operation the Long Beach steam plant furnishes almost as much excitation to the system as the two Eagle Rock condensers combined, the only cost of supplying this extra kva. being the loss due to generating and transmitting this extra current to the load center, which is probably not more than the power required to operate these condensers at full load.

At the present time it is proposed to move one of the 2000-kva. condensers from the Colton substation to the Saticoy substation. Owing to the rapid increase of load on the Saticoy line the voltage regulation on this line is poor and the condenser will be of greater value at Saticoy than at its present location.

The problem of determining the most economical kva. load to be carried on the various generating stations feeding into a common system, upon which there are operated condensers of various capacities, is by no

means a simple one. The method employed by this company for solution of this problem is illustrated by the chart shown in Fig. 4. This chart is calculated and constructed so that the proper kva. load to be carried on the Kern River No. 1 plant and Long Beach steam plant, which will give the minimum line loss, may be read directly from the chart. This chart is for use in connection with operation of the 66,000-volt transmission lines from Kern River No. 1 and the Long Beach steam plant to the Los Angeles No. 3 receiving station and is calculated for the following conditions: System power factor, 70 per cent; total power-factor correction, 11,000 kva., made up of 5000-kva. line capacity and 6000-kva. condenser in operation at full load at the Los Angeles No. 3 station. To illustrate the method of using this chart let it be assumed that the total load to be delivered is 40,000 kw. and that the water conditions are such that the Kern River plant can furnish 16,000 kw. of this load, the balance, or 24,000 kw., to be carried on the Long Beach plant. The problem is to determine the proper loading of kva. on the two plants to give the minimum line loss. This may be determined by use of the chart as follows: Locate the 16,000-kw. line on the chart, using the scale on the right. Follow this line until it intercepts the 24,000-kw. line on the scale at the top of the chart; this locates a point on the original cross-section of the chart which gives the desired kva. to be carried on each plant. From this point follow the cross-section lines of the paper down to the lower scale, which will give 32,200 kva. to be carried on Long Beach steam plant, and follow the cross-section lines to the scale at the left, which gives 18,000 kva. to be carried on Kern River No. 1. Such charts should be constructed for various power factors and combinations of the principal plants feeding into the system.

In addition to the synchronous condensers, this company has on its system three 6000-kw. synchronous motor-generator frequency-changing sets in operation, changing the frequency of current from 50 to 60 cycles

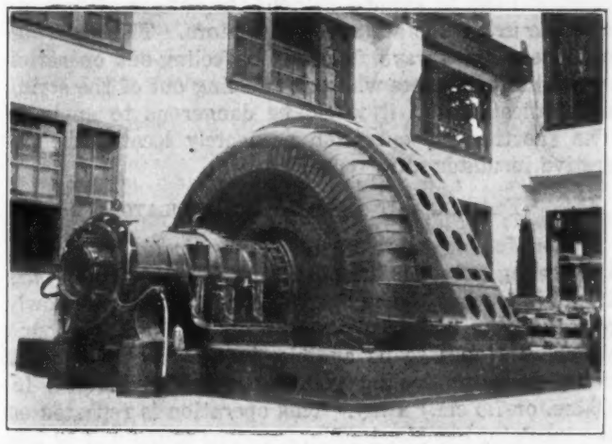


FIG. 5—ONE OF THE 15,000-KVA. SYNCHRONOUS CONDENSERS AT EAGLE ROCK SUBSTATION

for interconnection with other companies operating in southern California. These units are operated with automatic voltage regulators in their field circuits and furnish considerable exciting current to both the 50-cycle and 60-cycle systems One of each of these units is located at Capistrano, Colton and Magunden. In addition to interconnection through frequency changers certain generating equipment in various plants is operated at other than its rated frequency directly for the benefit of and on the system of interconnected companies.

The following is a list of condensers (totaling 52,000 kva.) now in operation on the system of the Southern California Edison Company:

	No. of Condensers	Capacity Each, Kva.
Eagle Rock substation	2	15,000
Colton substation	4	2,000
Los Angeles substation No. 3	1	6,000
Katella substation	2	2,000
Inglewood substation	1	2,000
Chino substation	1	2,000

Fig. 3 is a map of a portion of southern California, showing the transmission system of the Southern California Edison Company, subsidiary and interconnected companies, also the location of generating stations, important switching stations, condenser stations and motor-generator stations Fig 5 is a photograph of one of the large condensers.

THE RELATIVE ADVANTAGES OF ALTERNATING-CURRENT MOTORS

Machines Which May Be Used for Industrial Purposes — Double-Squirrel-Cage, Multispeed, Repulsion-Induction and Single-Phase Types

Where alternating-current motors are employed for industrial purposes the squirrel-cage and wound-rotor induction motors are most frequently used, but in some cases double-squirrel-cage, multispeed, repulsion-induction and single-phase motors may be utilized. In view of the fact that the characteristics of these motors are not so well known as those of the plain induction motors they will be briefly outlined below.

The double-squirrel-cage motor has a high-resistance, low-reactance squirrel cage close to the rotor surface and a low-resistance, high-reactance squirrel cage embedded in the rotor. The latter gives torque and good speed regulation and with little loss near synchronism, while the surface conductors give high torque at low speeds and standstill. The combination thus gives a uniformly high torque over a wide speed range but at some sacrifice of power factor due to the high reactance of the lower squirrel cage.

With the multispeed motor, which has its primary windings arranged so that the number of poles and consequently the speed can be changed, the power factor is necessarily lower at the low speed than at high speed; but it is the most extensively used adjustable-speed induction motor.

Repulsion motors, or single-phase commutator motors in which the armature is short-circuited and energized by induction from a stationary compensating winding, give better commutation than series motors at moderate speeds. They usually have varying speed or series characteristics, although repulsion-induction motors merely have these characteristics in starting and run as plain induction motors thereafter.

Single-phase commutator motors may have their armature, field and compensating circuits energized by conduction or induction, in the former case having series or shunt characteristics depending on the connections and in the latter repulsion-motor characteristics. As shunt motors they can be used as constant-speed high-starting-torque motors or as adjustable-speed motors. By lagging the field magnetism, as by shunted resistance, the motor can be used for power-factor compensation.

Locating Defective Transmission-Line Insulators

Details of the "Buzz-Stick" Method That Can Be Used on Live High-Voltage Lines to Detect Faulty Insulators of Suspension or Pin Type, Together with the Construction and Use of Special Tools Required

BY T. F. JOHNSON, JR.
General Electrical Superintendent, Georgia Railway & Power Company

A SIMPLE, economical and accurate test, which is called the "buzz-stick" method, has been developed by the writer and extensively used under widely varying conditions on live transmission lines of all types for locating defective insulators of either the suspension or the pin type. For locating defective suspension insulators it can be used at any voltage provided that there are not fewer than two insulators per suspension or dead end. While the minimum number of insulators is limited to two, there is no limit to the maximum number per string, provided that the operating voltage of the line is not less than about 20 per cent of the operating voltage for which the line is insulated. For example, the "buzz-stick" method can be used on a line built and insulated for 110,000 volts but operated at 22,000 volts. However, if the same lines were operated at 13,000 volts or 11,000 volts, it would be difficult to obtain accurate results. The method applies equally well to all makes of suspension-type insulators, both single-part and multiple-part, and will indicate the particular type of defectiveness which is characteristic of each make. The condition of suspension-type insulators can be determined all the way from perfectly good, through the different degrees of defectiveness, to totally bad. In other words, it will locate all insulators which will puncture before they will flash over.

The accuracy of this method can be checked by the use of the three methods commonly in use—the megger, the oscillator and the 60-cycle test. Any insulator shown bad or defective will probably pass any one of the above tests, or perhaps any two, but it will probably not pass the three. However, it is entirely possible for an expert tester to locate defective insulators which will not show defective on any of the tests mentioned. These insulators, if left in the line, will go dead in a period of time which clearly indicates that they were defective in spite of the showing made on other tests.

The "buzz-stick" method is also an accurate test for locating defective multiple-part pin-type insulators or for locating any defective unit part of a multiple-part pin-type insulator. It will work on pin-type insulators of any design now made except single-part pin-type insulators and those designs of multiple-part insulators in which the cement holding the insulator together is entirely covered by the porcelain parts. There are, however, a large number of insulators which at first sight seem to belong to the latter class in which the cement can be easily reached by properly designed points on the testing tools. The "buzz-stick" method will locate, with the exceptions stated, any defective multiple-part pin-type insulator regardless of the degree, small or great, of the defectiveness. It will also locate any defective unit part or parts in any combinations and in any degree of defectiveness in any multiple-part pin insulator on any transmission line carrying any voltage.

To use this test method for locating faulty suspension or pin-type insulators the line must be alive. It is a part of the system developed and used by the writer for maintaining all classes of transmission lines without disturbing the operation of these lines. Naturally the use of this method requires study and practice, but the knack is soon acquired and the testing rapidly done by a good lineman.

Details of the ways the tests are made and of the construction of the special tools required are given in the paragraphs that follow for locating defective insulators of either suspension or pin type.

Testing Suspension Insulators with a "Buzz Stick"

The instrument or tool used when testing out suspension insulators is a treated stick about 8 ft. or 10 ft. (2.4 m. or 3 m.) long and 1¼ in. (3.1 cm.) in diameter. On the end of this stick is fitted an adjustable wire fork, as shown in Fig. 1, with both prongs or horns electrically connected together. This tool is called the "buzz stick," and the method of testing the insulators is called "buzzing" them. There are two steps in the "buzzing" of a string of insulators—first, what is called feeling them out; second, what is called shorting them out. The feeling-out operation always precedes the shorting-out operation and determines the general condition of the string. While it does not definitely determine the exact condition of the string, it gives a fair indication and shows whether or not the shorting-out operation can be applied without the danger of flashing or puncturing the string of insulators. The shorting-out operation always follows the feeling-out operation except in those cases where the feeling out of the string has indicated that it would be dangerous to apply it. The shorting-out operation accurately locates the defective insulator unit.

Feeling Out a String of Insulators

When feeling out a string of suspension insulators, the feeling point on the horn *A* of Fig. 1 of the "buzz stick" is touched to the line conductor and drawn slowly away. There is then produced a distinct buzzing sound which continues to be audible, in the case of 110,000 volts, until the feeling point is some 2½ in. or 3 in. (6 cm. or 7.5 cm.) away. This operation is repeated on the insulator cap No. 1 (Fig. 2). The sound will be less distinct and will follow the feeling point at a shorter distance. When the operation is repeated for insulator caps Nos. 2 to 8 (Fig. 2) in succession, it will be found that the sound is less for each cap as the distance from the line increases, until on cap No. 6 or 7 there is very little or no sound and the sound from cap No. 8 is louder than from No. 6 or No. 7. Such results indicate a perfectly good string of insulators.

Assume now that insulator No. 2 is totally bad—in other words, dead. In this case the sound from caps No. 1 and No. 2 will be the same and cap No. 6 or No. 7

will produce a sound. In case insulator No. 6 is bad, then caps No. 5 and No. 6 will produce the same sound and the sound from cap No. 7 will be very much increased.

Assume that insulators Nos. 2, 3 and 4 are dead. Then the sounds from caps Nos. 1, 2, 3 and 4 will all be equal and the sounds from caps Nos. 4, 5, 6, 7 and 8 will be very much magnified. In other words, the sound from the cap of a dead insulator is the same as the sound from the cap of the next insulator to it nearest the line. In any of the above assumed cases it would be safe to apply the shorting-out process. If all insulators are dead except two, to apply the shorting-out process would knock the line out.

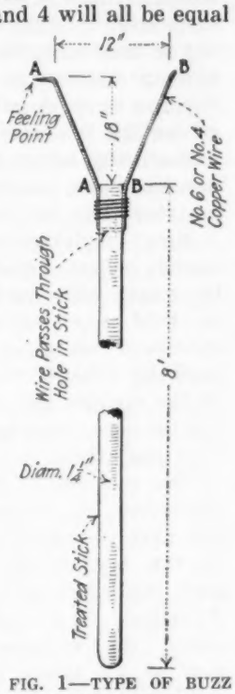


FIG. 1—TYPE OF BUZZ STICK USED WITH SUSPENSION INSULATORS

It is a common occurrence on lines that are three or four years old to find strings of insulators to which the feeling-out operation will indicate that it is unsafe to apply the shorting-out operation. This is essentially the case in dead ends. In these cases it is advisable to count the whole string as defective, remove it and separate the good insulator units from the defective ones by other tests. The feeling-out operation is for the purpose of determining, without the possibility of flashing or puncturing the string, if there is a sufficient number of good insulator units left in the string to stand the line potential when one of the good insulator units is shorted out during the shorting-out process. On 110,000-volt lines there must be at least three good units to stand the shorting-out process. On lower voltage there must be at least two good units, except on voltages such as 11,000 and 13,000, where there are only two insulator units per string. Then only one unit need be good.

SHORTING OUT A STRING OF INSULATORS

In applying this test touch either one of the horns of the "buzz stick" (Fig. 1) to the line conductor. Hold this horn in contact with the line and make and break contact with the other horn with cap No. 1 (Fig. 2). There will be produced a snappy spark on making and breaking contact with cap No. 1. Then hold either of the horns in contact with cap No. 1 and make and break contact with the other horn with cap No. 2. A snappy spark will be produced on making and breaking contact with cap No. 2, but the intensity of the spark will be less than when the horn was held in contact with the line conductor and the other horn touched to cap No. 1. Repeating this operation across each insulator unit in the string, it will be found that the intensity of the spark will diminish as the distance from the line increases until insulator No. 8 is shorted out, when the spark across this unit will be found to be more than across unit No. 7. These conditions indicate a perfectly good string.

Assume now that unit No. 2 is dead. When this unit is shorted out as described there will be absolutely no spark. If unit No. 6 is dead likewise, no spark will be produced. With dead insulators in any number and any combination the results will be the same; that is, absolutely no spark across the dead unit.

Assume the case that insulator unit No. 5 (Fig. 2) is slightly defective—that is, the value of the flashover voltage is only slightly greater than the voltage which would puncture it—and that all other units in the string are good. Under these conditions the spark obtained from cap No. 5 will be less than when insulator unit No. 5 is good and the spark from cap No. 6 will be greater. This is so for any insulator in the string, no matter how slightly defective. Bad, or dead, and very defective insulators will have to be removed before the slightly defective insulators in the same string can be detected. In the case of lines from which insulators are removed and replaced with the lines out of service, the worst insulators are located on the first test with the "buzz stick" and the slightly defective insulators are located on subsequent tests made after the worst insulators have been removed. When the lines are maintained while under operation, the tester precedes the maintenance crew and locates and marks with paint, by means of a brush on the end of a stick, the most defective insulators. The maintenance crew follows the tester, replacing the marked insulators while the line is alive. After they have done this they "buzz" the string out and at this time locate and replace the slightly defective units. A line which is maintained dead will require, as a general rule, more frequent testing than when maintained at operating voltage.

THE SILENT INSULATOR IN A STRING

In every string of insulators, regardless of the make, the number of insulators in the string or the voltage

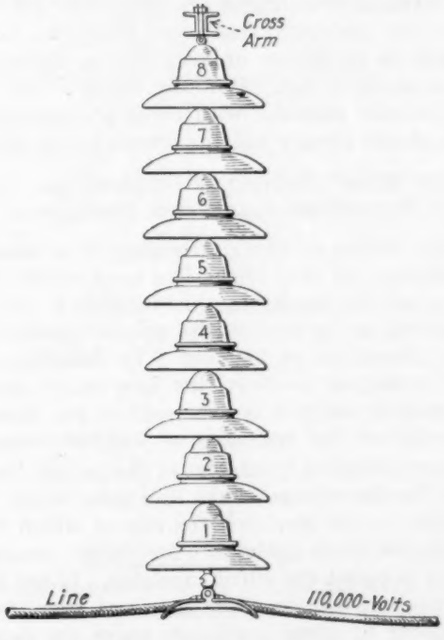


FIG. 2—STRING OF SUSPENSION INSULATORS AS NUMBERED FOR BUZZ-STICK TEST

on the line, there is one insulator in the string the cap of which will give the minimum spark both in the feeling-out process and the shorting-out process. This insulator is generally the second one from the cross-arm. As soon as the tester has tested a sufficient number of strings on a given line to locate this silent cap and

knows the character of the spark and sound given off by it when the string is entirely good, it is no longer necessary for him to test in detail each string. By touching the feeling point of the "buzz stick" to this cap he can easily determine whether the string is entirely good or not. If the spark from the cap is normal, he can pass on; if it is abnormal, he should "buzz" the entire string out and definitely locate and mark the defective insulators. A tester soon becomes expert and will be able by touching the cap of the silent insulators to tell the number of defective units in the string, although it is always necessary to "buzz" the entire string out to locate the units definitely.

It is obvious that in this case the line voltage must be low, such as 22,000 volts or 13,000 volts or 11,000 volts, and there will always be at least one good unit. Since there are only two units, the one which is good and the one which is bad must be determined accurately by the feeling-out process. A trial will show that this is easily done. When the bad one is determined by the feeling-out process that unit can be then checked by the shorting-out process. There is no need to test the second unit, nor is it possible. A tester can best acquire his skill on longer strings and consequently higher voltages before he tries to test the shorter strings.

The use of the "buzz stick" is accompanied by some dangers until the tester acquires skill. These dangers are due to the likelihood of an inexperienced tester flashing a string and knocking the line out. To avoid these dangers the tester should test the lowest string on the tower first and should always stand well below the string he is testing. When this is not possible, he should stand with the wind blowing from him to the string. He should wear colored glasses to protect his eyes. If these precautions are taken, the arc if one is started, will always travel away from the tester and there will be no danger of his standing under a string which is about to fail. However, when a man becomes expert he may dispense with these precautions, except that he should always test the lowest string first.

"Buzz Stick" Method of Determining Proper Number of Suspension Insulators

When a source of electrical energy is at hand of the same pressure as that of the line upon which it is proposed to use the insulators, the "buzz-stick" method can be employed to determine the proper number of suspension insulators to be used. To illustrate, assume that it is desired to determine how many suspension-type insulator units it is necessary to put in series on a transmission line operating at 110,000 volts.

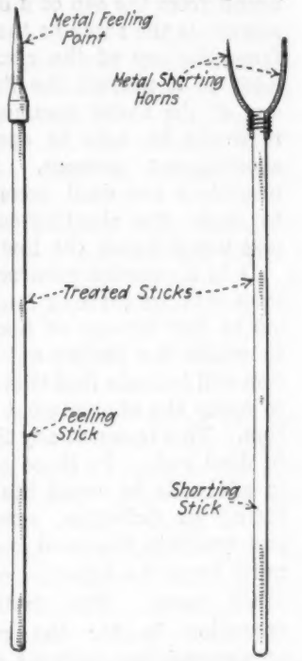
In every string of insulators of the proper length and number for the voltage of the line upon which they are used there is one insulator the cap of which will give the minimum spark during the feeling-out process. This insulator is called the silent insulator. If the string is too long, there will be more than one silent insulator. The number of silent insulators there are depends on the amount of over-insulation of the line. The silent insulator is not always absolutely silent—whether it is or not depends on the make of the insulator—but it is in all makes the insulator the cap of which gives the minimum spark of any cap in the string during the feeling-out process.

Now, to find the proper number of insulators for the above-assumed case apply 110,000 volts to a string of insulators and add or take units from the string until there is one silent insulator, which should be the second or third one from the ground. This string would then be sufficient for 110,000 volts. The same procedure would apply for any voltage, regardless of the make of insulator or whether the insulators were to be used on suspension or dead ends.

For dead ends the number of units which should be used in addition to give a greater factor of safety is simply a question of personal opinion and the frequency of testing the lines. It is undoubtedly better to have one too many insulators in a string than too few.

New insulators can be tested before using them by means of a rack built to hold any number of strings of insulators and by applying voltage to one end of the strings and grounding the other ends and then "buzzing" them.

The method of testing insulators of more than one part is exactly similar to the testing of single-part insulators as already described. The cement between the various parts acts at all times like so much metal as far as the "buzz stick" is concerned. Knowing this, the test can be made between the cement and the cap of the insulator, or between the cement and the pin of the insulator, or between cement and cement. Care should be taken in making this test that one horn of the "buzz stick" is actually in contact with the cement, otherwise the indications will be deceptive.



FIGS. 3 AND 4—THE TWO TYPES OF BUZZ STICKS REQUIRED FOR TESTING PIN-TYPE INSULATORS

It is advisable never to send less than two men to test the insulators with the "buzz stick" on any line, one to do the testing and one to do the marking or painting of the defective insulator. The defective insulator should be marked while the tester has his "buzz stick" across it, and the men should check each other; otherwise it is surprising how often the wrong insulator will be marked.

It has been found that a brilliant red paint is the most desirable color to use for marking and that it should be very thick. One large mark on the head of an insulator is used to indicate a totally dead unit, two marks on the head indicate a defective insulator, one large mark on one of the porcelain parts indicates that particular part to be dead, and two small marks indicate that particular part to be defective. The markings of the testers should, whenever possible, be so placed and of such size as to be easily seen from the ground.

Cost of Testing with "Buzz Stick"

By averaging the cost of testing 100,000 units of various types on a variety of lines it was found that the cost per unit, including all expense except royalties, was 8.3 mills. Adding royalties the cost would be, at a maximum, 3 cents per unit, and at a minimum for a system having a large number of insulators about 1.5 cents per unit. The use of the "buzz stick" does not

entail any loss due to the shutting down of the line. but even with the elimination of this point the method compares favorably with any other method of testing insulators.

A zero record on line outages due to insulator failures can be obtained with very inferior insulators. The more inferior the insulators the more frequent should be the test and removals, the better the insulators the less frequent the tests and removals; but in both cases a zero record of interruptions due to insulator failures is possible. The writer would like to point out that absence of interruptions due to insulator failures does not mean a perfectly operating line. Transmission-line outages are sometimes the results of causes other than insulator failures, but any one will grant that if insulator failure outages are eliminated transmission lines will give more nearly continuous service.

Replacing Defective Insulators on Live Line

Although the "buzz stick" opens a way to locate defective insulators while lines are in regular operation, it does not provide a way to replace these defective insulators while the lines are in regular operation. However, the writer has methods for this purpose for use on any type of line. These methods have been in use about five years, and where they are in use both the testing and the insulator replacements, as well as all other transmission-line maintenance, are carried on without interfering in any way with the operation of the system, or the operation of the system delaying or causing inefficiency in the maintenance of the lines.

The following figures are the result of actual tests with the "buzz stick" and megger:

"BUZZ STICK" TEST

Number of insulators	88,577
Cost, at 8.2 mills per unit	$727.37
Royalties, at 2 cents per unit	1,771.54
Line outage for test	0
Total cost	$2,498.91

MEGGER TEST

Number of insulators	88,577
Cost, at 9 cents per unit	$7,971.93
Royalties	0
Line outage for test, at $10 per hour	10,000.00
Total cost	$17,971.93

COMPARISON

Megger	$17,971.93
"Buzz stick"	2,498.91
Difference	$15,473.02

As an example of what the use of the "buzz-stick" method of locating defective suspension insulators will accomplish on a given line, reference can be made to the case of the Atlanta-Tallulah Falls line of the Georgia Railway & Power Company. During the year previous to the adoption of the "buzz-stick" method by that company the Atlanta-Tallulah Falls line was out twenty-nine times owing to insulator failures. For the year subsequent to the adoption of the "buzz stick" there was not a single interruption due to insulator failures. The company has not had a single insulator failure on lines which have been tested with the "buzz-stick" method. Insulators are tested and removed on these lines once a year; consequently the results obtained form a good basis for the opinion that interruptions due to insulator failures have been reduced to a negligible quantity.

The tools required in applying this method are of two types, as shown in Figs. 3 and 4. Fig. 3 is called a feeling stick. Two sticks of this kind are needed when the insulators under test have more than two parts, but only one stick of this kind is needed when the insulators under test have only two parts. It consists of a stick about 1¼ in. (3 cm.) in diameter and about 8 ft. (2.4 m.) long, composed of suitable insulating material, at one end of which is fixed a sharp metal point of suitable shape, the shape depending on the type of the insulators to be tested. This metal point is known as the feeling point. Fig. 4 is what is called a shorting stick. Not more than one shorting stick is ever needed. It also is a stick about 1¼ in. in diameter and about 8 ft. long, of suitable insulation material, with a continuous metal fork attached to one end, the shape and dimensions of the fork depending on the shape and dimensions of the insulators to be tested.

In Fig. 5 is shown a type of insulator which it is assumed for the purpose of illustration is to be treated by this method. The method followed in testing this insulator, which it is also assumed is on a 60,000-volt line, will be exactly similar, fundamentally, to the method followed in testing other insulators on other lines. There are two distinct steps in the operation, as in the case of testing suspension insulators, one known as the feeling process, done with the feeling stick (Fig. 3), and one known as the shorting process, done with the shorting stick (Fig. 4). In testing an insulator both the feeling process and the shorting process must be used. The feeling operation or process always precedes the shorting operation or process and determines and indicates the general condition of the insulator

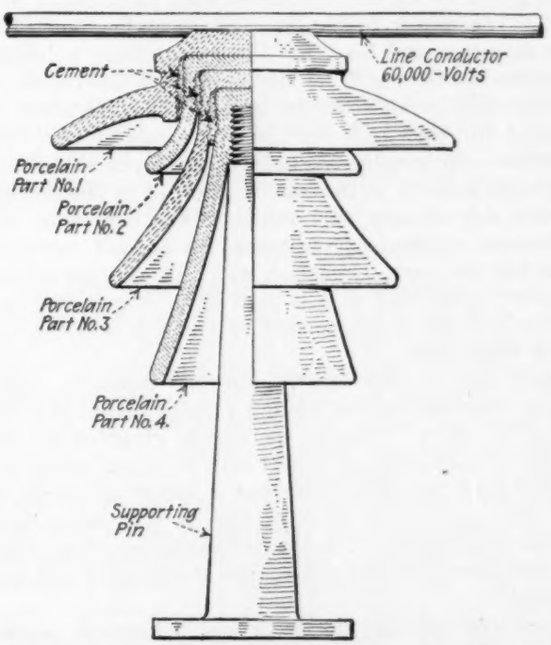


FIG. 5—MULTI-PART PIN-TYPE INSULATORS WITH PARTS NUMBERED FOR REFERENCE IN BUZZ-STICK TEST

From these indications it is easily judged whether or not the shorting operation can be applied without danger to the line or to the men making the test. Sometimes the feeling operation indicates that the shorting operation cannot be applied at all, as is always the case with very defective insulators. The feeling operation is very inaccurate, but its results will always clearly show if the application of the shorting operation would be dangerous. The shorting operation is very accurate in

the locating of defects, but is prohibitively dangerous unless preceded by the feeling operation and its application governed according to the indications of that operation.

In this operation the point of the feeling stick is touched to the line conductor and drawn slowly away, when a distinct buzzing sound will be produced, which in the case of a 60,000-volt line will be audible until the feeling point is an inch or more away from the line conductor. The operation is repeated by touching the cement between porcelain parts No. 1 and No. 2 (Fig. 5). The sound will not follow the point nearly so far as it did from the line conductor if porcelain part No 1 is perfect. When porcelain part No. 1 has become defective the sound drawn from the cement between parts No. 1 and No. 2 will increase, approaching nearer and nearer the sound drawn from the line conductor as part No. 1 becomes more and more defective. From the above it is natural to conclude that when part No. 1 is totally defective the sound from the line and the sound from the cement between parts No. 1 and No. 2 will become equal. This natural conclusion is only seldom verified by what actually happens on the line. The sounds approach near enough to equality, under almost any conditions, to excite suspicion about part No. 1, while it is the very exceptional instance in which they become equal.

The operation is repeated by touching the feeling point to and drawing it slowly away from the cement between parts No. 2 and No. 3. If part No. 2 is perfect, the sound given off by the cement will be less than the sound given off by the cement between parts No. 1 and No. 2. The nearer to equality the sounds approach the more defective part No. 2 is. When part No. 2 is totally defective the sounds from the cement on each side of the part will in all cases be equal. This operation is repeated for each unit part of the insulator, and the difference (the greater the difference the nearer perfect the porcelain part) in the sounds given off by the cement on each side of any part indicates the degree of defectiveness of the part between the cement sections. When the last part is reached, which in the case of the insulator shown in Fig. 5 is part No. 4, the feeling operation is made on the cement on one side and the pin on the other side.

Every part of the multiple-pin-type insulator reads true to form during the feeling process except the top part of the skirt. That is, the sounds given off by the cement on each side of a part will be equal when the part between the cement sections is totally defective or dead, whereas the top skirt or part is very often dead and the sound given off by the line conductor on one side and the cement on the other side of the part will not be equal.

When the feeling process gives indications which would tend to show that an insulator is very defective, there is no need to use the shorting process. When the feeling process indicates that the insulator is entirely good, the shorting process should be used. This process locates parts which are only slightly defective and also parts which are totally defective.

SHORTING OUT A PIN INSULATOR

The shorting-out process should be applied to an insulator only after the feeling process has been applied first and he has clearly indicated that it would be entirely safe to apply it. Those parts of the insulator under test which seem to show indications of being defective during the feeling process should be shorted first. This is desirable because if one of the good parts were shorted first the insulator might flash, whereas by shorting the defective parts first the number of good parts remaining is definitely established and is also the degree of defectiveness of each defective part.

To short an insulator of more than two parts, two feeling sticks are required, such as are shown as Fig. 1. In this operation place the feeling point of a feeling stick firmly against the cement between parts No. 1 and No. 2 (Fig. 5). Place one horn of the fork of the shorting stick against the line conductor and hold it there; make and break contact with the feeling point with the other fork of the shorting stick, when a snappy sounding spark will be produced. If the top skirt or part is perfect, the sound of the spark will be that of the normal, good top skirt. If the top skirt is defective, the sound of the spark will be less than the normal spark of the perfect top skirt. As the top skirt becomes more and more defective the spark obtained in the way described will decrease in intensity, but it will seldom or never reach zero.

Then place another feeling point on the cement between parts No. 2 and No. 3 and short with the shorting stick between this feeling point and the feeling point on the cement between parts No. 1 and No. 2. As described above for part No. 1, a snappy spark will be produced the sound of which, when part No. 2 is good, will be less than the spark produced across part No. 1 when part No. 1 is good. The sound of this spark will decrease as part No. 2 becomes more and more defective and will be zero when part No. 2 is totally defective or dead.

The same conditions hold good for all the remaining insulator parts. When the last part, No. 4, is reached, the shorting is done between a feeling point on the cement parts No. 3 and No. 4 and the pin supporting the insulator, if the pin is metal. If the pin is wood, a feeling point is forced as far as possible up inside the insulator next to the wood pin and the shorting is done between this feeling point and the feeling point on the cement between parts No. 3 and No. 4. In the case of wood pins the bottom skirt acts very much like the top skirt.

On the system with which the writer is connected two men per crew are used in applying this method, and the defective insulators are marked conspicuously with red paint. These testing crews are followed by the maintenance crews, which replace all marked insulators. Both the testing and the replacing of the insulators are done with the lines alive. This method will not indicate cracks on the outer edges of the porcelain parts, nor will it indicate broken insulators. Defects of this nature can be seen by the human eye and need no method of test. It will, however, indicate all defects when they extend into the main body of the insulator, such as cracks, holes, porosity and otherwise defective porcelain. By the use of this method and the removal of the defective insulators all occurrences of punctured insulators on a system can be eliminated.

The methods described for locating defective insulators have been developed by the writer in connection with the maintenance work on high-voltage lines of the Georgia Railway & Power Company and have been patented in this country, Canada and most foreign countries.

Rectifying High-Tension Alternating Currents

Experiments with High-Tension Rectifier, Consisting of a Gap Between a Point and a Plate, Indicate the Most Favorable Gas, Gas Pressure and Electrode Construction— A Sustained Efficiency of 85 per Cent Is Reported

BY SAMUEL COHEN

DURING the year 1914, while experimenting with spark gaps for use in radio-transmitting apparatus, which were to be supplied by high-tension unidirectional currents, the writer found a new method by which to obtain these currents. Although these high-tension currents were utilized for radio work, yet they can be used with equal success for other purposes where such currents are desired, as, for instance, in operating electrical precipitators, X-ray tubes, etc. The only available rectifying apparatus for voltages exceeding 5000 volts are at present those of the synchronized rotating commutator and kenotron vacuum valve. Another method of obtaining a partial rectification of a high-tension discharge consists in passing a current from a point to a plate. This process has been known for a long time, but the commercial application of the principle was unsuccessful owing to its inconsistency and poor operating efficiency. But the rectifier, when properly constructed and when its discharge medium is subjected to a gas under pressure, will be found to yield high efficiency and satisfactory consistency of operation. An efficiency of 85 per cent was obtained by the use of NH_3 under a pressure of about 100 lb. per square inch (7 kg. per sq. cm.), and successful operation was obtained by using an iron point and a rotating aluminum disk. It is thus the purpose of this article to give a short detailed description

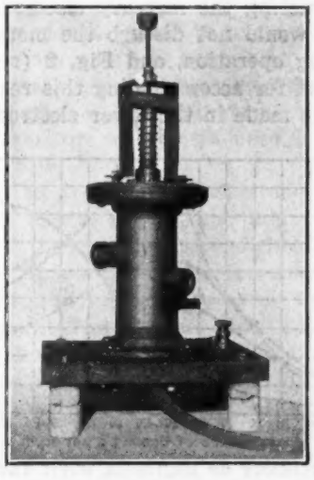


FIG. 1—EXTERNAL VIEW OF RECTIFYING ELECTRODES

of some of the results and a description of the apparatus used in the experiments.

The rectifying apparatus is shown in Fig. 1. Within the chamber there are two electrodes made as shown in Fig. 2 (left). The upper or movable electrode was made from aluminum, $\frac{5}{8}$ in. (1.6 cm.) in diameter. The lower or fixed one consisted of a copper rod of the same diameter and with its end turned conically as shown. Through the center of this copper electrode a small hole was drilled and used to allow gas to pass through and strike the upper electrode. When these electrodes were connected to the secondary terminals of a high-tension transformer and in series with a direct-current ammeter and a load resistance it was found that the meter would indicate the presence of the rectified current. However, it was observed that the current was not steady enough, owing to the poor cooling of the elec-

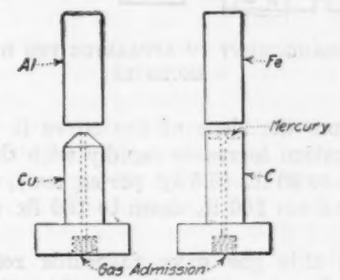


FIG. 2—ELECTRODE CONSTRUCTION USED IN EXPERIMENTS

trodes, as the conical point began suddenly to wear away.

This trouble was remedied by admitting into the axial opening of the lower electrode air under various pressures, and it was immediately found that the rectified current became steady and the value of the current increased many times the value noted prior to the admission of the gas.

AIR FIRST USED AT THE ARC

The next step was to ascertain the effect of various pressures of the admitted air on the efficiency of the apparatus in reference to the rectified alternating current. In obtaining the data for this experiment the apparatus were connected as shown in Fig. 3, where a 60-cycle, 110-volt alternator is shown connected to a 20,000-volt transformer through a variable reactor, *R*, in the primary circuit. A voltmeter, *V*, and a wattmeter, *W*, were also connected in the primary circuit. The secondary of the transformer was connected to the rectifying discharger, *D*, through a specially made direct-current ammeter, *A*, load resistance *LR*. An electrostatic voltmeter, *V*, and a safety spark gap, *SG*, were shunted across the secondary leads. The distance between the electrodes was kept constant throughout the test at about $\frac{1}{8}$ in. (3.2 mm). Various pressures from 0 to 200 lb. per square inch (14 kg. per sq. cm.) were admitted, and the efficiency of rectification with respect to primary input power was noted. The curve marked "air" (Fig. 4) gives the results obtained from this experiment. It is seen that the efficiency of rectification is quite low at lower pressures, and between 150 lb. and 170 lb. per square inch (10.5 to 11.9 kg. per sq. cm.) the best results were obtained with an efficiency of practically 75 per cent. Although the figure seems to be a rather high rectifying value, it was impossible at

the time to carry out more precise work for verification owing to the unsuitable equipment used in all these investigations. Yet the values appear very consistent, as they were checked several times.

OTHER GASES ARE INVESTIGATED

Carbon-dioxide (CO_2) was the next gas under investigation, and it was found that maximum rectification was noted at less pressure than that obtained for about the same percentage of input current. From the curve it will be noted that 90 lb. per square inch (6.3 kg. per sq. cm.) was the value observed for maximum rectification. From the slope of the curve it will be noted that rectification increases rapidly with the increase of pressure up to 80 lb. (5.6 kg. per sq. cm.), and decreases very slowly from 100 lb. down to 180 lb. (7 kg. to 12.6 kg.)

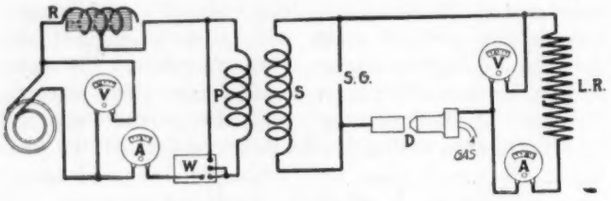


FIG. 3—ARRANGEMENT OF APPARATUS FOR HIGH-TENSION RECTIFIER

Although this gas gave favorable results, it was found that long periods of operation of the rectifier decreased its efficiency. As carbon-dioxide in a short spark field decomposed to a certain extent and created a carbon film on the surfaces of both electrodes, it thus increased the resistance of the discharge and hence decreased its efficiency. It was found at times that absolutely no rectification was observable due to the excess carbon film adhering to the electrodes. It was thus necessary to clean the electrodes carefully in order to continue the investigation. One advantage in favor of this gas is stability of operation.

Sulphur-dioxide (SO_2) was also tried, and it was possible to obtain a much higher percentage of rectification with the same amount of primary-power input in the primary transformer circuit than that obtained by the use of carbon-dioxide. However, the difficulty with the use of this gas is somewhat the same as with the former, since the sulphur-dioxide decomposed into its elements, sulphur and oxygen, causing a collection of sulphur film upon the surfaces of the electrodes, which caused the increase of resistance of the spark field. This decreased its over-all efficiency. Sixty per cent was the maximum percentage of rectification that could be obtained by the use of this gas at 120 lb. per square inch (8.4 kg. per sq. cm.) as indicated in Fig. 4.

By this time the writer was fully convinced of the difficulty of using this type of high-tension rectifier, namely the instability of the apparatus after long periods of use.

AMMONIA PROVES EFFICIENT MEDIUM FOR RECTIFICATION

Other means were then tried in order to make the instrument more stable for continuous periods exceeding five hours. Various cooling devices were applied to the electrodes in order to accomplish the results. Finally ammonia under pressure was passed through the rectifying gap in the same manner as were the others. The cooling effect of the gas during expansion was utilized to advantage in this apparatus, and not only was it found to act as a cooling agent, but at the same time it was found that the percentage of rectification was greatly increased as compared with gases previously used, and it will be noted from Fig. 4 that as high as 85 per cent efficiency was obtained with ammonia gas at 100 lb. per square inch (7 lb. per sq. cm.) Most remarkable stability was obtained with this gas for periods up to ten hours' duration. Results were noted at half-hour periods and it was found that the variation of rectified current did not exceed 1 or 2 per cent. There are two reasons why ammonia proved much more efficient than other gases, namely, (1) the electrodes are kept cool, thus preventing a vaporization of the spark electrodes due to the intense heat of the spark or arc field; (2) the spark field is inclosed in an atmosphere of nascent hydrogen, which has the remarkable effect of increasing the spark field. In this disintegration of the ammonia into its constituent elements of nitrogen and hydrogen the first, being inert, has no effect upon the function of the apparatus.

It was found after a period of two weeks of practically continuous use of the apparatus that the surfaces of the electrodes were practically the same as at the beginning, thus indicating that they operated at a lower temperature than their vaporization point. From the experiments it may be concluded that the ammonia gas seems to be the most satisfactory solution for increasing the efficiency of this apparatus.

EXPERIMENTS WITH ELECTRODES

Various combinations of metallic electrodes were tried, and it was found from actual experiments that a combination of aluminum and copper gave most suitable results. The next investigation undertaken was to determine the effect of mercury in a hot spark field, in a gas atmosphere, and to note the rectification obtained by the use of this metal. Difficulty at first was had in constructing the mercury electrode so that the admitted gas would not disturb the mercury from its position during operation, and Fig. 2 (right) shows a method utilized for accomplishing this result. A circular groove was made in the lower electrode so that the gas opening did not come in contact with this groove, thus avoiding contact between the mercury and the gas opening. The metallic mercury was at first placed in this groove. The maniscus of the mercury was just high enough to avoid coming in contact with the gas. The various gases as utilized in the previous rectifier were utilized with this form of rectifier and ammonia gas proved again most effective. However, the difficulty experienced in the use of this rectifier was that of partial short-circuiting of the electrodes, due to the partial vaporization of the mercury, thus preventing mo-

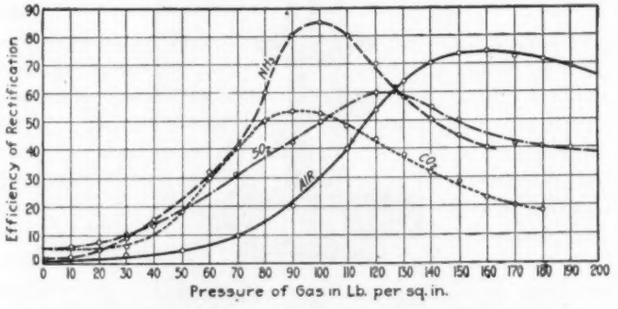

Efficiency of Rectification
Pressure of Gas in Lb. per sq. in.
NH3
SO2
AIR
CO2
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200

FIG. 4—EFFICIENCY OF RECTIFIER WITH VARIOUS GASES

mentarily the operation of the device. During these periods it was found necessary to increase the admitted gas pressure in order to avoid this excess vaporization. It was necessary, however, to reduce the pressure in order to obtain maximum rectification. The critical gas pressure for obtaining this maximum rectification was noted to be the same as when used in the previous rectifier, namely, 100 lb. per square inch (7 kg. per sq. cm.).

The only advantage favoring the use of mercury as an electrode was that of constant stability at overload for short periods. For longer periods of overload, however, the device failed to perform its functions, owing, perhaps, to the short-circuiting of the electrodes with mercury vapor.

The only disadvantage experienced in the use of aluminum as one of the electrodes was that of pitted

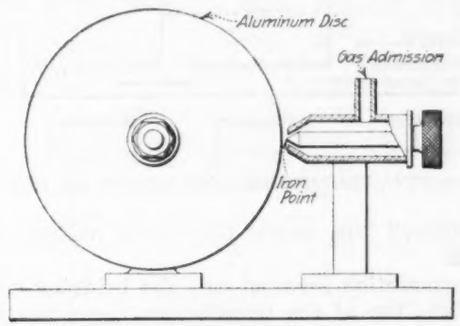


FIG. 5—CONSTRUCTION OF ALUMINUM GAP AND IRON-POINT ELECTRODE

surfaces noted at its operating surface. This was undoubtedly due to the low melting temperature. It was found from actual experience that as soon as the aluminum surface began to pit the efficiency of the instrument was considerably lowered and it was thus necessary to face down its working surfaces every time this efficiency decreased. In order to avoid this detrimental effect, it was necessary to use a rotating aluminum disk so as to give a new sparking surface at all times during the operation of the instrument. Fig. 5 shows the construction of the instrument used. The aluminum disk was rotated by a motor.

In this case an iron-pointed electrode was utilized for the second electrode, and the admitted gas was passed through the cylinder as indicated. The insulated knob was fastened to the iron-pointed electrode to allow of gap adjustment between the aluminum disk and the pointed electrode. Very satisfactory results for continuous operation were obtained with this instrument, and it is the only means by which satisfactory results were obtained for continuous operation in rectifying high voltages. The investigation has by no means been completed. Further investigation will be made and additional data on this subject will be given in the near future.

Locating Petroleum by Electricity

By means of an electrical device crude petroleum, no matter how far beneath the earth's surface it may be, has, it is said, been located in the shallow field near Corsicana, Tex. The inventor of the instrument has gone to the outlying district to make further tests. The oil industry may be revolutionized if oil pools can be discovered by this means.

GROUNDING ARC CIRCUITS AN UNDESIRABLE PRACTICE

Procedure Recommended by New England Central-Station Engineers When Working on Arc Circuits —Best Procedure Is to Treat All Lines as Alive

THE question of safeguarding arc circuits has been taken up by the Central Maine Power Company with several central stations in New England, in view of accidents occasionally arising from the crossing of such lines with 2200-volt primary wires. George S. Williams, general superintendent of the company, pointed out in a circular letter that in the past all employees having anything to do with line work have been continually instructed to consider arc circuits during the daytime as alive and to use the same precautions adopted in connection with 2200-volt lines. It was hoped that some means of automatically indicating crosses or grounds on arc circuits might be developed, but so far this has not proved practicable. A copy of this letter, which was sent to various central-station engineers, brought out the following opinions:

G. M. Hardy, superintendent Worcester (Mass.) Electric Light Company, informed the Central Maine company that at Worcester no special protection has been found necessary. In that city there are fifty-three series circuits, the highest voltage being 7500 and most of the circuits being run at 4500 volts. There appears to be no case on record of a man being injured by contact with a live arc circuit at a time when it was supposed to be dead, although accidents have occurred from the application of test currents when men were working for other purposes on the same pole. In the Worcester company's view, it would be highly undesirable to ground the arc circuits, this being seemingly much more dangerous than to leave them free. As the Worcester system is arranged, seventeen series circuits are operated from points where there is no attendant, so that any method of giving alarm would be expensive and practically out of the question.

The Malden (Mass.) Electric Company, according to Manager J. T. Day, has found no device which is an actual protection to series circuits when not in use. The practice is to consider such lines as alive at all times, using rubber gloves freely in handling them. W. T. Oviatt, general superintendent Narragansett Electric Lighting Company, Providence, R. I., believes that grounds on arc circuits produce an undesirable hazard. This company's experience is that a ground on an arc circuit usually burns out a large number of lamps when crossed with lower voltage lines and is expensive. Good construction and maintenance, with at least three daily tests, appear as reliable as any safety device that can be placed upon the circuit.

L. L. Elden, superintendent electrical engineering department Boston Edison company, points out the difficulty of preventing shocks to linemen who come in contact with street-lighting circuits while working on live primary circuits, owing to the capacity currents resulting. In a distribution system operating a number of circuits it is difficult to see how any safety device which might indicate an arc circuit which was alive could be of value unless it indicated the alternating-current circuit with which it was crossed. This is of doubtful feasibility. The grounding of arc circuits, as the Central Maine company appreciates, is a decided element of danger to linemen. The best procedure seems to be to insist that all linemen working on poles

treat all wires as alive and govern themselves accordingly, for so far as the grounded wire proposition is concerned, they already have that to contend with in the form of the neutral or grounded wire of the secondary of transformers feeding distributing mains running on poles on a line supporting primary wires.

W. R. Eaton, electrical engineer Cambridge (Mass.) Electric Light Company, also favors handling all lines as though they were alive unless all parts of the apparatus of circuits are directly under the supervision of the men concerned at the time of working on the equipment. The Central Maine company requires that series lamp circuits shall not be tested at full voltage if it can be helped, and that tests shall not be made except in accordance with a time schedule, concerning which all persons who may be affected are informed. Linemen are instructed to cut off tie wires to minimum lengths of 1½ in. to 2 in. (3.75 cm. to 5 cm.).

RECONNECTING TRANSFORMERS TO CHANGE VOLTAGE RATIO

Big Expense Was Saved in Changing Over a Rotary Converter from 33 Cycles to 60 Cycles by Reconnecting the Transformers

IN CUTTING over a 33-cycle rotary converter to 60 cycles there was involved the problem of maintaining normal rotary voltage, both alternating-current and direct-current, when three air-blast transformers were operated from an 11,000-volt, 60-cycle bus instead of a 10,000-volt, 33-cycle bus. Considering the voltage ratio problem, it was first proposed to cut out a sufficient number of secondary turns to correspond to the increase in primary voltage, *i.e.*, from 10,000 volts to 11,000 volts. After giving the matter a little thought, however, it was found that a reconnection of transformers would solve the problem at a much less expense.

In any balanced three-phase circuit the three voltages may be represented as by the equilateral triangle

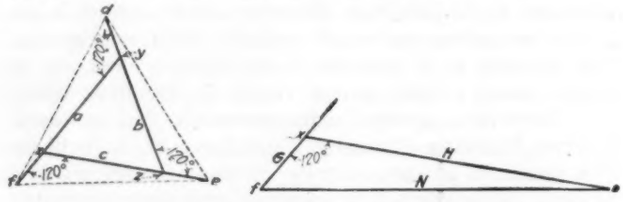


FIG. 1—VECTOR DIAGRAMS FOR TRANSFORMER CONNECTIONS

xyz in Fig. 1. If the sides *a*, *b* and *c* of this triangle be equally extended to *f*, *d* and *e*, the new triangle *fde* will also be equilateral.

Applying this combination of triangles to the solution of a method of connecting the primaries of three 10,000/430-volt transformers to an 11,000-volt bus in such a way as to maintain 430 volts on the secondary, it is necessary to solve the triangle *fxe* for the value *fx*, when $fe/xe = 11{,}000/10{,}000$ and the angle *fxe* is 120 deg.

Let *xe* be represented by *H* and equal 10,000, and let *fe* be represented by *N* and equal 11,000. Solving for *fx* or *G*:

$$N^2 = G^2 + H^2 - 2GH \cos 120°,$$
$$\text{or } 11{,}000^2 = G^2 + 10{,}000^2 - 2G10{,}000(-\tfrac{1}{2}),$$
$$\text{or } 11{,}000^2 = G^2 + 10{,}000^2 + G10{,}000,$$
$$G = 1780, \text{ which is } 17.8 \text{ per cent of } 10{,}000.$$

For an absolutely correct result it would be necessary to connect one end of each primary winding to a point 17.8 per cent from the other end of the primary winding of the transformer preceding. The bus connections would then be from points *d*, *e* and *f* (Fig. 1).

The primary windings of the transformers, however, were made up of six equal coils, one coil being one-sixth, or 16.7 per cent of one primary winding. Connecting the transformers as indicated below (Fig. 2) and solving the triangle in Fig. 1 for the value of *N* when *G* equals 1666 (one-sixth of 10,000), *H* equals 10,000 and the angle *fxe* equals 120 deg., it is found that *N* equals 10,930. Thus, if the transformers are connected as indicated in Fig. 2 and operated from

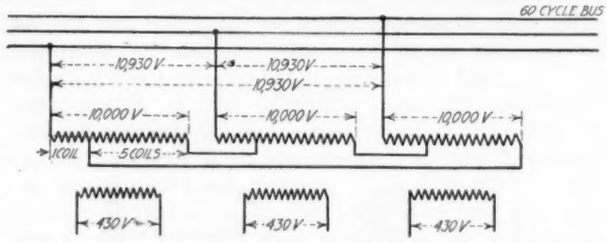


FIG. 2—ACTUAL TRANSFORMER CONNECTIONS FOR NEW RATIO

an 11,000-volt bus, nearly the correct voltage will be obtained.

This connection involved only the bringing out of a lead at the top of the transformers from the jumper connecting coils 5 and 6, which was done at a very small expense as compared to the cost of cutting out some of the secondary turns.

The credit for working out this scheme of connections is due to D. W. Proebstel, one of the company's engineers.

WAGES can be raised temporarily by legislation or by the shock tactics of a group of men whose services for the moment are essential. But no individual or company can be forced to employ people at a loss, and there is evident danger of unemployment on a large scale if workmen put too high a value on their services. There remains the one hopeful way, by increasing production, care being taken that the increased product is well distributed. It must be remembered that skill of management is limited and the best results cannot be universally obtained. At the same time on the side of labor there must be no waste of productive power, but plant and machinery must be put to their maximum use. Greater encouragement of skill, more facilities for promotion from unskilled work to skilled, better education and an improved physique, which may result from higher wages, more leisure and better environment, together with full opportunity for use of all intelligence, strength and skill, irrespective of sex, and without due insistence on pedantic rules as to previous training, would result in a much fuller use of the latent abilities of the race than has hitherto been possible.—*L. F. Loree, president Delaware & Hudson Company.*

Readers' Views and Comments

HOW A. I. E. E. CHANGES MAY LESSEN SCIENTISTS' SUPPORT

The Institute Must Not Lose Sight of the Precedence of Research Work—Suggestions for Retrenchment as Opposed to Popularization

To the Editor of the ELECTRICAL WORLD:

SIR: Every step of progress in electrical engineering has had its first impulse in scientific discovery. Sometimes the movement starts in the research laboratory, sometimes it is predicted by the mathematical development of theory, sometimes it is the ingenious extension of known principles, sometimes the bold application of principles on a larger scale. But always the creative genius, using imagination coupled with scientific knowledge, is the first to open the new path.

Each new step broadens the whole field, adds its designers, its manufacturers, its operators, in fact creates new engineers of all grades in increasing numbers, building up the strength of the profession.

Recognizing the dependence of the profession on scientific attainment coupled with creative and adventurous enterprise, the Institute in the past has, in accordance with the clear purpose expressed in its constitution, devoted its organ of publication to the stimulation of the highest type of professional attainment. This clear purpose has undoubtedly been a powerful factor in the marvelously rapid advance of the profession and industry and has placed the Institute in its present proud position.

THE DANGERS IN POPULARIZATION

The question now is raised whether the official organ of the Institute should not be made to appeal more directly to the rank and file of the membership by presenting news and other material bearing more directly on daily business and personal activities. It is proposed that this be done while at the same time continuing the past policy of making its principal feature the presentation and discussion of matter essentially new and contributory to the progress of the profession. In short, it is proposed to popularize the *Proceedings*.

In this suggestion it is probable that the wish, rather than a certain vision, is father to the thought. It appears extremely doubtful whether a popularized advertising publication can still be made to attract the best efforts of theorists, scientists and creative engineers. Certainly there is no present example of such a publication. The experiment of the Society of Mechanical Engineers is too new to offer evidence. The journals of all purely scientific organizations are devoted exclusively to the presentation of the highest efforts of their members without reference to popular appeal or earning capacity. Electrical engineering, dependent in a peculiar way on pure science, must also offer the fullest encouragement to those using that science for its furtherance. Popularization necessarily and inevitably leads to a lowering of the scientific quality of published matter to the level of the average taste. In such a case where is the stimulus to the scientist and creative engineer?

It is surprising that the development committee should have found such a widespread complaint as to the present character of the *Proceedings*. It is suggested that the "rights" of 95 per cent of the membership are being disregarded. It is a strange word to use in a society whose objects under its constitution are "the advancement of the theory and practice of electrical engineering and of the allied arts and sciences and the maintenance of a high professional standing among its members" (Article I, Section 2). The present methods of the Institute have appealed sufficiently to attract the recent remarkable growth in membership, and it is difficult to understand why so many should now be dissatisfied. The discussion might be clarified considerably by a publication of some of the expressions of dissatisfaction.

Therefore also an extension of the advertising policy of the Institute would appear to be most unfortunate. Pointed comments on this proposal have already been made in your columns, but perhaps the clearest light of all is thrown by President Townley's statement in his letter to the membership to the effect that for a successful advertising extension subject matter must be presented which will have a wide appeal. The subject matter thus must appeal to possible purchasers of electrical materials. Was this the purpose of the *Proceedings* in the minds of the founders of the Institute?

For like reasons any changes in the present plan of holding Institute meetings should be in the direction of encouraging the attendance and participation of leading engineers. This is the surest way of stimulating new effort, attracting important papers, and especially of attracting ambitious younger men.

President Townley's letter to the membership frankly indorses the advertising extension on the ground of the necessity for increased revenue to meet an expanded publication policy, a new wider program of activities and increased cost of operation. Since, in the opinion of many leading members, the means proposed are fraught with danger to the standards of the Institute, perhaps the wisest course at this time of high prices would be to postpone till a happier day some of the more expensive proposals for expansion and adopt instead a program of retrenchment. Several of the proposed expansion activities, such as those on an engineering conference, local federations and engineering education, can be encouraged at relatively small cost. In several sections the local federation has already taken a healthy start.

SUGGESTIONS FOR RETRENCHMENT

In the direction of retrenchment the elimination of the *Transactions* appears most obvious. There is undoubtedly a wide sentiment against such a move, but it can hardly be well founded. In reality the free distribution of the *Transactions* is a great luxury. Most members who value and make use of the *Transactions* would be willing to bind their own *Proceedings*. Another more difficult method of retrenchment would be the acceptance of fewer papers. Not all of the papers printed in the *Proceedings* are worthy of publication, and many are too lengthy. Not a pleasant job for the meetings and papers committee, but something should be possible in this direction. In other words, if we can't expand or continue on our income, let us use retrench-

ment so as to improve our standards, rather than increase income by unworthy means.

J. B. WHITEHEAD,
Professor of Electrical Engineering.
Johns Hopkins University, Baltimore, Md.

STICK TO FUNDAMENTALS PROVED BY PAST SUCCESS

Mr. Ashe Favors the Appointment of a Business Manager to Eliminate Unnecessary Expense While Avoiding Innovation

To the Editor of the ELECTRICAL WORLD:

SIR: I have read with considerable interest the various articles which have appeared in the ELECTRICAL WORLD bearing on the report of the development committee of the American Institute of Electrical Engineers. It seems that, like most organizations, the American Institute of Electrical Engineers is passing through a process of over-inflation due to the heavily increased costs of the service rendered to its members, with the result that it is necessary to develop new ways of raising funds to maintain the same character of service. I have always appreciated the wonderful stimulus which the Institute has been to the younger engineers in the electrical profession and also the outlet which it has afforded the older men to bring their ideas before the engineering fraternity. It would seem as though the future of the Institute would be best furthered by following along the same general lines of development and by concentrating on fundamentals. This has been the keynote of its success in the past.

In my opinion, it would be a most unfortunate mistake for the Institute to diverge from its former policy to expand into the fields of general education, advertising, popularizing scientific subjects and the publishing of general articles of elementary interest. What the Institute really needs, in my opinion, is the services of a good business manager whose experience has been particularly along educational and publication lines, and at the same time one who would be sympathetic to the research and development problems of the industry. I think the Institute could well afford to pay $10,000 a year to the right man provided that such an individual could be found. With the business experience which such a man would have he would readily know how to go about to eliminate the unnecessary expenses which have come about with the rapid development the Institute has passed through.

I hope these suggestions will be taken in a friendly spirit from one who has always been interested in the Institute and who of late years because of his close contact with industrial problems has not been able to take an active part in Institute affairs. S. W. ASHE,
Head of the Educational and Welfare Department,
Pittsfield (Mass.) Works of the General Electric Company.

Developed and Undeveloped Power on the Androscoggin River

To the Editor of the ELECTRICAL WORLD:

SIR: I note in the ELECTRICAL WORLD for Aug. 23 a review of the report of the Commission on Water Conservation and Water Power for the State of New Hampshire, in which are given various tables and diagrams taken from the report.

What purports to be a quotation from the article prepared by Walter H. Sawyer, published in the New Hampshire report, gives "the total developed and undeveloped power in New Hampshire," showing what purports to be a total developed head of 294 ft. and a total undeveloped head of 268 ft., with corresponding power statistics.

The above figures as prepared by Mr. Sawyer represent developed and undeveloped power on the Androscoggin River in New Hampshire, and not total developed and undeveloped power for the state.

C. H. PIERCE,
District Engineer, U. S. Geological Survey.
Boston, Mass.

Short Circuits on Iron-Wire Transmission Lines

To the Editor of the ELECTRICAL WORLD:

SIR: My attention has been called to an article in the ELECTRICAL WORLD for June 14, 1919, page 1277, by W. C. Heston, entitled "Iron-Wire Transmission Line Proves Disastrous." I believe Mr. Heston is blaming the wrong portion of his equipment. From tests we have made I find that under short-circuit conditions the increase in resistance curve becomes flat at the saturation point of the iron. The maximum increase in resistance found at 60 cycles was 23 per cent for a seven-strand, $\frac{5}{16}$-in., 40 per cent copper-clad steel and nearly the same in the case of $\frac{5}{16}$-in. galvanized messenger strand.

A three-phase short circuit is rather unusual but should not cause any more damage, if as much, than a single-phase short circuit. The transformers were most likely damaged through high potentials being developed in the windings and would have been damaged as much with a copper line. Mr. Heston does not state whether or not the transformers were protected with fuses on the primary end.

I am not an advocate of the practice of universal use of iron wire, but I do believe that it has never been given a square deal. I would like to see complete data given with each case where such iron circuits have failed, for this is the only method by which we can check up statements made at random through the technical press. H. E. WEIGHTMAN,
Chief Engineer Engineering Service Company.
Chicago, Ill.

Ice Diversion and Hydraulic Models

To the Editor of the ELECTRICAL WORLD:

SIR: Referring to the article entitled "Model of River Made to Study Water Conditions," which appeared in the ELECTRICAL WORLD for July 19, 1919, the reader's attention should be directed to a paper entitled "Ice Diversion, Hydraulic Models and Hydraulic Similarity," read before the American Society of Civil Engineers on Jan. 2, 1918, by B. F. Groat. (See *Transactions* of the society, Volume LXXXII, page 1138, 1918.)

It should also be stated that Mr. Groat, as inventor, holds letters patent issued by the Dominion of Canada covering all the general types of intake described in the article first mentioned above, and that similar claims have been allowed Mr. Groat by the United States Patent Office. JOHN THOMPSON.
Pittsburgh, Pa.

THE SWEEPING CHANGES IN THE COST OF LIVING

Survey of the National Industrial Conference Board Shows Increase of 71 per Cent in July, 1919, as Compared with July, 1914

The cost of living for American wage earners was 71 per cent higher in July, 1919, than at the outbreak of the world war in July, 1914, according to a preliminary statement issued by the National Industrial Conference Board based on a careful survey of conditions the country over. This represents an advance of 6 per cent since March, 1919, and of 12 per cent since June, 1918. The increase of 71 per cent to July, 1919, makes the highest point yet reached and compares with an increase of 61.3 per cent to March, 1919; of 65.9 per cent to November, 1918, and of 52.3 per cent to June, 1918.

The total percentage increase for the five-year period since the beginning of the war in the average cost of each of the principal items entering into the family budget was: All items, 70.8 per cent; food, 85 per cent; shelter, 28 per cent; clothing, 100 per cent; fuel, heat and light, 57 per cent; sundries, 63 per cent.

Percentage increases since last March were as follows: All items, 5.9 per cent; food, 5.7 per cent; shelter, 4.9 per cent; clothing, 10.5 per cent; fuel, heat and light, no change; sundries, 5 per cent.

DISTRIBUTION OF WAGES BY PERCENTAGE

In combining these separate items to obtain the increase in the budget as a whole, account has been taken of the fact that approximately 43 per cent of the income of the average wage earner's family is spent for food, 18 per cent for shelter, 13 per cent for clothing, 6 per cent for fuel, heat and light, and 20 per cent for sundries. This distribution is based on studies of the expenditures of a large number of families made by the United States Bureau of Labor Statistics and other authoritative government and private agencies. The method of computing the percentage of change in the cost of living on the basis of the increases found for the separate items by the National Industrial Conference Board is shown below:

Budget Items	Relative Importance in Family Budget	Increase in Cost Between July, 1914, and July, 1919	Increase as Related to Total Budget
All items	100.0	..	70.8
Food	43.1	85*	36.6
Shelter	17.7	28	5.0
Clothing	13.2	100	13.2
Fuel, heat and light	5.6	57	3.2
Sundries	20.4	63	12.8

The allocation of expenditures for the different budget items usually varies so little among the families of wage earners that with any reasonable distribution there would be but slight deviation from the average increase of 71 per cent since 1914. This figure is, therefore, broadly representative of conditions the country over. But it should be emphasized that special local, racial or other circumstances may at times make necessary some revision to adapt this estimate to meet specific conditions. This is especially true of rents, since changes in this item have at times differed considerably in separate communities. With the data given, however, such necessary adjustments may readily be computed.

* Based on an increase of 84 per cent up to June 15, 1919, as reported by the United States Bureau of Labor Statistics.

Estimates of changes in the cost of living made by the board on the basis of retail prices and expenditures for the separate budget items by average families must not be confused with changes in wholesale price index numbers such as Bradstreet's, Dun's or those of the New York *Times Annalist*. The only accurate measure of changes in the cost of living is that based on retail prices weighted according to the proportion of the total budget spent for each item by average families.

Few important changes in the cost of gas and electricity to small consumers between March and July, 1919, were reported, although the tendency of rates was upward.

A summary of percentage changes in the cost of living, as determined in the four surveys made by the National Industrial Conference Board, is given in the table below:

Budget Items	July, 1914, to June, 1918	July, 1914, to November, 1918	July, 1914, to March, 1919	July, 1914, to July, 1919
All items	52.3	65.9	61.3	70.8
Food	62	83	75	85*
Shelter	15	20	22	28
Clothing	77	93	81	100
Fuel, heat and light	45	55	57	57
Sundries	50	55	55	63

* Based on an increase of 84 per cent up to June 15, 1919, as reported by the United States Bureau of Labor Statistics.

WE ARE face to face with a situation which is more likely to affect the happiness and prosperity, and even the life, of our people than the war itself. We have now got to do nothing less than bring our industries and our labor back to a normal basis after the greatest upheaval known to history, and the winter just ahead of us may bring suffering infinitely greater than the war brought upon us if we blunder or fail in the process. An admirable spirit of self-sacrifice, of patriotic devotion and of community action guided and inspired us while the fighting was on. We shall need all these now, and need them in a heightened degree, if we are to accomplish the first tasks of peace. They are more difficult than the tasks of war, more complex, less easily understood, and require more intelligence, patience and sobriety. We mobilized our man power for the fighting; let us now mobilize our brain power and our consciences for the reconstruction. If we fail, it will mean national disaster. The primary step is to increase production and facilitate transportation, so as to make up for the destruction wrought by the war, the terrible scarcities it created, and as soon as possible to relieve our people of the cruel burden of high prices. Only by keeping the cost of production on its present level, by increasing production and by rigid economy and saving on the part of the people can we hope for large decreases in the burdensome cost of living which now weighs us down.—*Woodrow Wilson.*

STATION & OPERATING PRACTICE

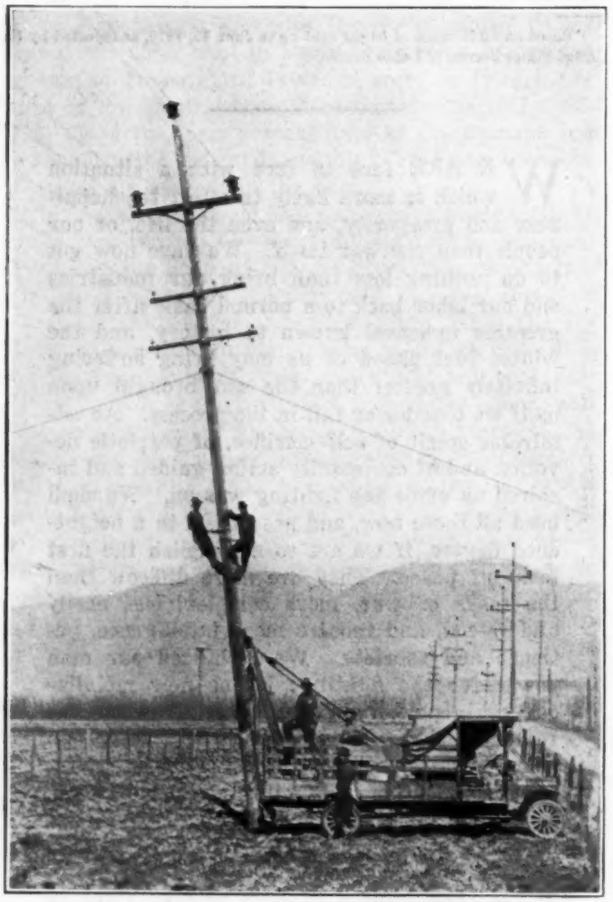
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

MOVING POLES WITHOUT UNTYING LINE CONDUCTORS

How Five Poles Were Moved a Distance of 40 Ft. with Eight Conductors in Place on Cross-arms

When it was necessary recently to move five 65-ft. (20-m.) poles carrying three 66,000-volt conductors, three 2300-volt conductors and a telephone line, a distance of about 40 ft. (12-m.) the following method was successfully used:

When ready to transfer the poles to their new locations across an alfalfa field, each one was guyed both ways at right angles to the line. By the use of a Simplex polejack the pole was pulled out of the ground and



POLE FASTENED TO A TRUCK READY FOR MOVING

attached to the rear end of a 2-ton truck. The truck was then backed across the 40-ft. space between the old and the new location and the pole dropped into place. One of the poles is shown above attached to the rear end of the truck and backed about one-third the distance.

By this method it was possible to move the five poles without untying the lines. It would also have been easily accomplished without killing the 66,000-volt circuit, but this was done as a matter of precaution. This change was made under the supervision of Samuel Alderson, superintendent of construction of the Pacific Power & Light Company at Yakima, Wash.

GEORGE C. SAWYER, District Manager.

Yakima, Wash.

HOW WATTAGE OF LUMINOUS ARCS WAS REDUCED IN DETROIT

Method Used to Change Magnetite-Arc Lamps for Operation on 272 Watts, Instead of 310 Watts, to Use More Lamps per Circuit

About 7000 magnetite luminous-arc lamps used for street lighting in Detroit, Mich., have been changed to permit the use of a lower wattage at the lamp terminals than that for which the lamps were originally designed. These lamps are operated by the Public Lighting Commission of Detroit, of which Frank R. Mistersky is superintendent. Street lighting in Detroit is almost entirely by magnetite-arc lamps, and the practice has been to use the regular 4-amp. series circuits with lamps adjusted for the usual 75 volts to 80 volts across the terminals, resulting in a consumption of about 310 watts per lamp. The lamps, which have been changed to lower wattage, are operated upon the same 4-amp. standard circuits, but are adjusted to about 68 volts across the lamp terminals, or 272 watts for the lamp. There is, of course, a reduction in the light due to the shortening of the arc. The life of the electrodes between trims is, however, increased. .

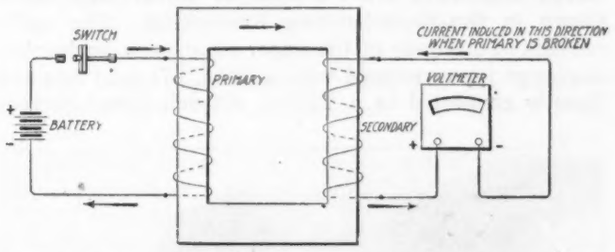
While the commission has made no photometric test of the influence of this change on street illumination, some experienced observers of street lighting have been asked to pick out the place on a given street where the 310-watt lamps left off and the 272-watt lamps began. The wild guesses on this point indicate that there is not sufficient difference to stand out among the numerous other variables entering into the illumination of a street with arc lamps. The reduction in wattage on these 7000 lamps in Detroit was done primarily to get additional lamps on various circuits without increase of lamp capacity or running entirely new circuits. The standard practice in Detroit previous to this innovation was to use double-tube mercury-vapor rectifiers and transformers supplying seventy-five-light circuits. With the reduced wattage ninety-two lamps are used per circuit. The reduced-wattage lamps are used on streets where any reduction in illumination is likely to be felt the least. The changes necessary in the General Electric arc lamps used to adapt them to the use of the oval electrodes cost less than 30 cents per lamp.

Chicago, Ill. J. R. CRAVATH.

SIMPLE TEST TO DETERMINE POLARITY OF TRANSFORMERS

Description of the "Kick" Method and Its Advantages When a Quick and Reliable Test Must Be Made

Electrical engineers in most industrial plants are confronted with the problem of determining the polarity of transformers. This most frequently occurs in those plants where testing transformers are used or where with transformers in banks or groups it is necessary to know their polarity. The polarity of new transformers is usually marked, but a great many old transformers and testing transformers are devoid of any markings whatever, so it becomes necessary to test them. There are several methods for doing this, each man usually having his own particular method.



SIMPLE DIAGRAM OF THE "KICK" METHOD TO TEST POLARITY OF TRANSFORMERS

The writer's favorite method is known as the "kick" or ballistic method, in which the transformer is used as an induction coil. By means of this method, which calls for one or two dry cells and a voltmeter, anything can be tested from a humble bell-ringing transformer to a large power transformer. The method is shown in the accompanying sketch, in which a battery is connected through a switch to one winding, which may be the primary, of a transformer, and a voltmeter to the other winding, or secondary. On closing the switch a current flows through the primary and sets up a magnetic flux. This flux induces in the secondary a voltage which tends a produce a current in such direction as to oppose the magnetic flux. On breaking the current in the primary a voltage is induced in the secondary in the opposite direction. That is, it tends to maintain the flux in the direction in which it was started by the primary current. The result is that the voltmeter will kick in one direction when the current is established and in the other direction when the current is interrupted. Therefore, if the voltmeter is so connected that a forward or positive kick is observed when the primary circuit is broken, then the secondary wire which goes to the voltmeter positive terminal is of the same polarity as the primary wire which goes to the positive side of the battery.

This method is quite reliable and can be easily and quickly carried out on any transformer, regardless of its size or location. This is one advantage over the method described by Clifford W. Bates in the Aug. 9 issue of the ELECTRICAL WORLD (page 290), in which the secondary voltage is placed in series with the primary, noting whether they add or subtract. This, of course, requires a source of alternating current, and in many cases it would be considerable trouble to get the proper service connection to the transformer or move the transformer to that service point. Moreover, in case of a transformer of very high ratio, there would be some difficulty in determining whether the secondary is added to or subtracted from the primary voltage, on account of the secondary voltage being small compared to that of the primary.

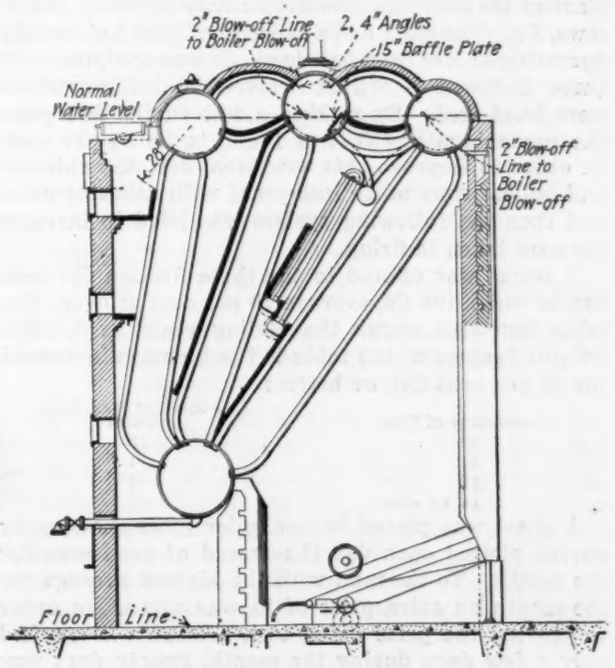
In the kick method the range of the voltmeter required will vary with the ratio of the transformer, but two dry cells and either a millivoltmeter or a 15-volt scale meter should be adequate to test any transformer.

G. N. HUGHES, Aluminum Company of America.
Maryville, Tenn.

SKIMMER IN 800-HP. BOILER ELIMINATES SUSPENDED MATTER

How a Baffle Arrangement Prevents Dirty Superheater, Clogged Lines and Coated Turbine Blading in Indianapolis Plant

The Indianapolis (Ind.) Light & Heat Company now employs a skimmer arrangement for some of its 800-hp. boilers at its Kentucky Avenue station to prevent particles of suspended matter from being carried over into the header by particles of water with the steam. This arrangement is shown in the accompanying drawing. Before this skimmer was installed the company had a great deal of trouble of this kind, due to the fact that after the water had passed through the water softeners it contained a quantity of suspended matter and when the boilers, which are set over Riley underfeed stokers, were operated at high rating particles of this suspended matter were carried over, causing a decrease in superheat and clogging up the lines and turbine blading. This trouble has now been entirely eliminated.



ARRANGEMENT OF BAFFLE SKIMMER

The skimmer has been installed as follows: Two 4-in. by 4-in. (100-cm. by 100-cm.) angle irons were placed lengthwise in the middle steam drum just above the steam circulating tubes. In addition to this one No. 12 sheet-iron baffle 15 in. (266 mm.) wide was installed lengthwise in the middle steam drum. It is 14.5 ft. (4.4 m.) long and is bolted on to three 2-in.

by 2.5-in. (50-mm. by 55-mm.) brackets about 3 in. (75 mm.) above the outlet of the circulating-water tubes which come from the front drum. This baffle plate is strengthened along its edges by two 1.5-in. by 1.5-in. (38-mm. by 38-mm.) angle irons. The baffle plate is situated so that it breaks the force of the water entering from the front drum, while the 4-in. by 4-in. (100-mm. by 100-mm.) angle irons check the upward rush of water within the drum.

A 2-in. (50-mm.) blow-off line is installed just below the normal water line in both the middle steam drum and the front drum. These blow-off lines run the length of the drum and are led into the boiler blow-off lines. This line is controlled with a 2-in. (50-mm.) valve, and there is a third 2-in. (50-mm.) valve beyond their union. About 58 ft. (26 m.) of piping is used for these lines with five 2-in. L's, one 2-in. T and two 2-in. unions, all extra heavy.

It required an average of four days to install each skimmer with two men working ten hours a day. The labor item, which amounted to $29.60, was the biggest item in the total cost of the skimmer.

Indianapolis, Ind. T. N. Wynne.

BENEFITS OF BONUS SYSTEM FOR SMALL-PLANT FIREMEN

Saves 4 Tons of Coal per Day in 1800-Kw. Plant at a Cost for Bonus Expenditures of About $10 a Month

A bonus system to increase efficiency in hand firing was very successfully inaugurated in the generating plant of the Southern Cambria Railway Company, Johnstown, Pa. The plant had a capacity of 1800 kw., usually operating at less than half load. It was equipped with three Babcock & Wilcox water-tube boilers, which were hand-fired. By making a test on the flue gases the percentage of CO_2 was found to be 5½ per cent. In order to improve this condition, first the chimney and boilers were made leak-proof with asbestos paint and then the following system was tried to increase the care taken in firing.

A bonus was offered to the three firemen for each run in which the Co_2 average 10 per cent or over. The table herewith shows the sliding scale used. The notable feature of the table is the increase in reward for 13 per cent CO_2 or better:

Percentage of CO_2	Bonus for Each Run, Cents
10	2
11	4
12	6
13 or over	10

A chart was placed in the boiler room showing by curves plotted each day the record of each man for the month. To the man with the highest average for the month an extra prize of $1 was given. In order to prevent the prize going to a fireman who worked only a few days during the month, twenty days was set as the minimum which he might work and have the same chance for the prize. For each day under twenty days 0.1 per cent was deducted from his monthly average.

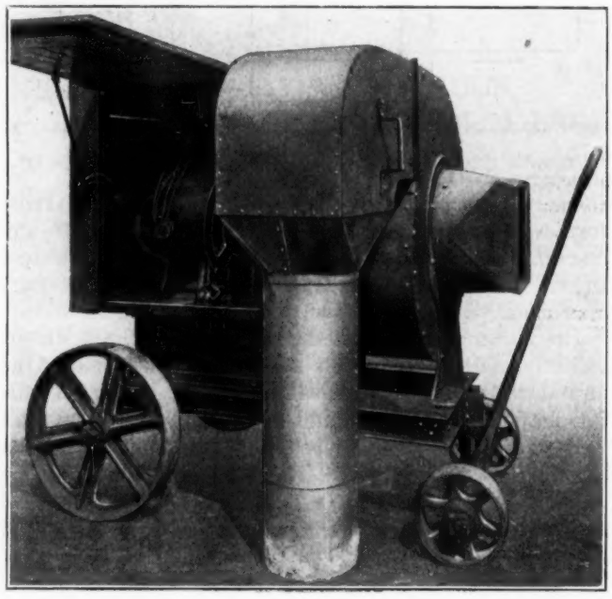
The system proved very successful; the CO_2 was increased to an average over 12 per cent and the coal consumption decreased from about 23 tons to 18 tons or 20 tons per day. This was accomplished at an entire cost in bonuses of from $8 to $10 per month.

Washington, D. C. H. E. Nichols.

HOT CABLE RUNS COOLED BY PORTABLE BLOWER

How a Motor-Driven Blower Mounted on Steel Truck Is Used to Provide Forced Ventilation in an Underground Duct Line

When a periodical temperature survey of an underground distributing system brings to light a particularly hot duct section of, say, 150 deg. Fahr. (65 deg. C.) or more, some means must be adopted to dissipate the heat if trouble is to be avoided. This is accomplished in Detroit by the use of locally applied forced ventilation from a portable blower such as is shown in the accompanying illustration. The outfit consists of a blower of the upper right-hand horizontal-discharge type equipped with a 28-in. (71-cm.) fan and directly connected to a 7.5-hp., 220-volt direct-current



PORTABLE OUTFIT FOR REDUCING LOCAL HEATING OF CABLES IN UNDERGROUND DUCTS

motor. The entire equipment is mounted on a steel truck.

When a particular hot duct run is discovered the blower outfit is hauled to the vicinity and mounted over the manhole at one end of the run. The discharge pipe from the blower is inserted in a circular sheet-iron plate of the same diameter as that of the manhole cover. The iron plate and the discharge pipe are then cemented in place with asbestos cement in order to make an air-tight joint. At the other end of the hot run a ventilating cover is placed which covers the manhole.

This cover consists of a number of 1-in. by 0.5-in. (25-mm. by 12.7-mm.) iron bars placed 0.75 in. (19 mm.) apart and bound together by a circular band. Direct-current service at 250 volts is furnished to the blower motor from some nearby pole or wall box, and everything is then ready for the blower to be set in motion. The cooling current of air is forced through the underground ducts in this manner until the temperature of the duct section affected has been reduced to the desired degree.

G. B. McCabe, Detroit Edison Company.

Detroit, Mich.

INDUSTRIAL APPLICATIONS

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

WELDING ROTOR BARS OF INDUCTION MOTORS

Points Found to Be Essential When Using an Ordinary Brazing Outfit in a Repair Shop

After some experimenting the writer has found it possible to weld rotor bars successfully to the end rings of a squirrel-cage rotor with an ordinary brazing outfit. The secret of a good job is in keeping the rotor bars and insulation in water up to the point of welding to prevent overheating and burning. The temperature required to burn off all grease and dirt and thus make a good weld is very high. However, when the rotor is held in water as mentioned this high heat has been satisfactorily used on repair jobs and a good electrical connection between the bars and end rings secured.

Springfield, Mass. THOMAS SHEEHAN.

GENERATORS ADAPTED TO CHARGE STORAGE BATTERIES

Various Points That Should Be Considered When Selecting the Type and Rating of Charging Outfits

Storage batteries are used nowadays in so many different places and for so many different applications that the question often arises of what apparatus or generator to use for charging the batteries. In many cases the operator who needs a charging generator is not familiar with the charging requirements. Frequently the maximum voltage and ampere-hour capacity of the battery is not known, and even when this information is available it is often thought that the generator will be satisfactory if the same voltage and ampere capacity which the nominal rating of the battery suggests is specified. That this is wrong will be apparent from the following illustration.

Assume that it is required to specify a generator to be used for charging a 32-volt lead-storage battery having an eight-hour capacity of 80 amp.-hr. This rating indicates that the battery is composed of sixteen cells and that its normal charging rate is 10 amp. for eight hours. This fixes the ampere capacity of the generator at 10 amp. also. The voltage required for charging the battery may be derived from the charging charateristic of the cells used. The characteristic may be obtained from the battery manufacturer or may be found in up-to-date reference books on the subject. By referring to such curves it will be seen that the voltage of a cell increases from about 2.2 volts to about 2.6 volts during an eight-hour charge at normal rate and that for the occasionally required overcharge the voltage per cell may increase to about 2.63 volts. This then indicates that the charging generator voltage must be capable of being adjusted up to $16 \times 2.63 = 42$ volts. It now remains to determine the type of generator. Should it be shunt-wound or compound-wound?

The best practice is to use a shunt generator. By using the shunt machine rather than the compound machine trouble with reversed series fields and loss of voltage as well as the possibility of charging above normal rate with an overcompounded machine are eliminated, and the charging may be done, if other conditions allow, in the most economic manner, without the use of external series resistance. Thus it has been found that the rating of the charging generator for this particular case should be 4.2 kw. at 42 volts, and the type should be shunt-wound. The speed at which the generator is to be driven depends to some extent on the speed of the driving motor, but this is not important from the standpoint of charging. The thing to be sure about is the voltage rating of the generator.

The conclusions to be derived from this illustration are not general. They must be modified for different conditions. For instance, if it is desired to charge occasionally at a higher rate than normal, the ampere capacity of the generator must be greater than 10 amp. Or if alkaline batteries are used instead of lead cells, the 32-volt, 80 amp.-hr. battery will consist of twenty-seven cells, the maximum charging voltage per cell will be 1.94 volts, and the normal charging current will be 15 amp. For such a plant the generator should be rated 27×1.94, or 55 volts and 15 amp.; that is, 6.75 kw. at 55 volts.

East Orange, N. J. H. H. METZENHEIM.

CAUSES OF BURN-OUTS USUAL IN MILL MOTORS

Operating Conditions That Are Responsible for Most Burn-outs and Reasons Why Machinery Should Not Be Overmotored

Mark Meredith's article in the Aug. 16 issue of the ELECTRICAL WORLD, page 359, gives the impression that the usual cause of burn-outs in motors is overloading. My experience in pulp and paper mills is that not over 5 per cent of all burn-outs can be attributed to this. At least 90 per cent may be traced to bearing failure. The other 5 per cent are caused by motors running single-phase, water or acid getting on the windings, oil from bearings rotting insulation on coils, or foreign matter such as nails or bolts getting caught in the rotor. Not every time a bearing fails is the winding ruined, but every time the bearing wears enough for the rotor to rub the stator the heat generated before the increased load will open the circuit breaker is much beyond what cotton or even mica insulation will stand without being carbonized. Carbonized insulation allows increased leakage of current which will still further weaken the insulation, and finally the winding will break down. The repair report card will therefore usually state "Burnt

out owing to overload." A larger motor will probably be installed, which, being underloaded, will lower the power factor and produce a real overload, due to temperature rise, on the generators and feeders.

In pulp and paper mills the power-factor problem is serious. Drives are being split up. Where formerly there were a comparatively few large motors carrying 90 to 95 per cent of their rating and holding the power factor at 85 to 90 per cent, we now have a large number of small motors doing not over 75 per cent of their rating and giving a power factor of 70 per cent or less. Superintendents and mechanical engineers are strongly inclined to overmotor machinery. In ordering a machine if the plans say it will take 50 hp. to drive it they will call for a 75-hp. motor. The smaller the amount of power needed the larger in proportion will be the motor installed. The writer has seen cases where the plans called for 2-hp. motors and 5-hp. motors were ordered and installed. The idea seems to be that there will be trouble enough with the machinery without being bothered by insufficient power. It would be unfortunate if, in addition to this tendency, the idea should become general that the usual cause of motor burn-outs is overloading.

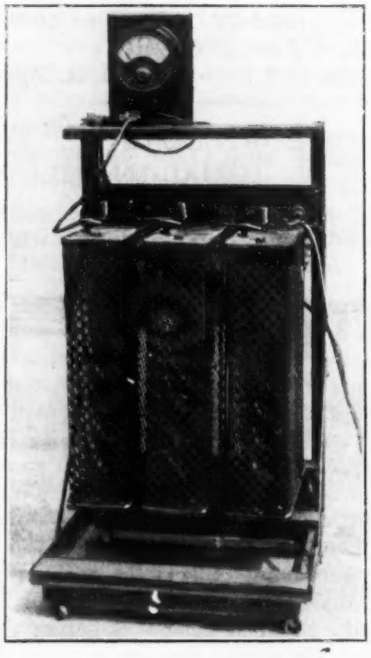
RALPH MCKINNEY.

Berlin, N. H.

A HOME-MADE BATTERY DISCHARGING RESISTOR

Resistance Wire Apparatus Displaces the Inconvenient Brine Barrels Which Were Previously Used for This Purpose

About twice a year at the service station of the United Electric Light Company, Springfield, Mass., it is customary to discharge completely the storage batteries installed on this company's electric trucks. A



PORTABLE RESISTOR UNIT WITH SHORT-CIRCUITING SWITCHES AND AMMETER

convenient portable resistor for this work has been designed by the writer and is illustrated herewith. It consists of three units with short-circuiting switches for each unit and an ammeter of 200 amp. maximum rating mounted on a wooden frame 2 ft. 2 in. (65 cm.) square at the bottom and 3 ft. 6 in. (106.6 cm.) high, the upright pieces being of 1½-in. by 1½ by $\frac{3}{16}$-in. (3.8-cm. by 3.8-cm. by 5-cm.) stock. A low shelf near the bottom and at the front permits the convenient transportation of a box of wire and tools, and the entire equipment is mounted on casters. The resistor has a capacity sufficient to discharge a battery of the 60-cell Edison A-12 type as used on the company's 5-ton truck equipment. Inconvenient brine barrels were formerly used in this work.

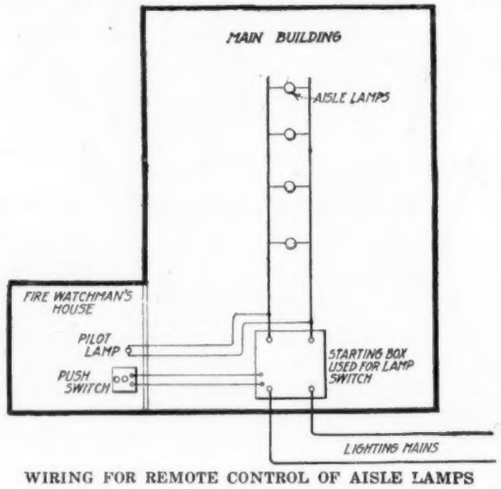
R. G. PROUTY.

Springfield, Mass.

REMOTE CONTROL OF LAMPS IN A LARGE BUILDING

How a Motor Starter Was Adapted for Remote Control of Aisle Lamps from a Watchman's Office

For controlling from a distance the ninety auxiliary aisle lamps of the immense main building of Sears, Roebuck & Company, Chicago, an ingenious piece of apparatus was installed. These lamps are used in



WIRING FOR REMOTE CONTROL OF AISLE LAMPS

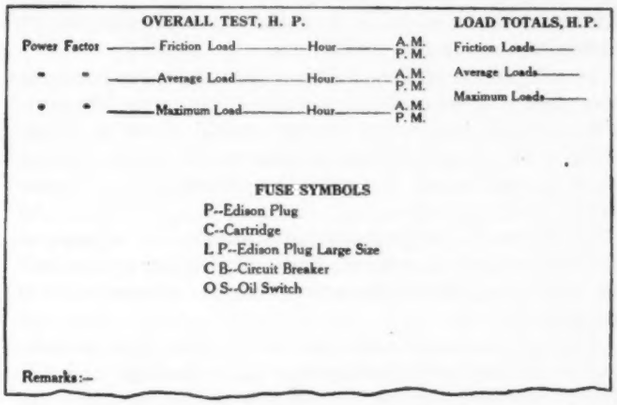
addition to the general lighting, which is controlled by switches in the respective rooms. They are lighted three times during the day—at starting time in the morning, at the noon hour and at quitting time in the evening. They are also used for special purposes at night and in emergency cases, such as a fire. Formerly it was necessary to send a runner from the fire watchman's house to the main switch in order to turn on these lights. This plan was found unsatisfactory and it was not desirable to run the main leads to the fire watchman's house. Therefore a small motor starter was mounted at the main switch, and leads for the starter and also for a pilot lamp were run to the watch house.

With this arrangement the man on duty in that house controls the lights by a push switch, turning them on and off at stated times. Moreover, with this method of operation no time is lost in case of emergency. By flashing the lights on and off at night this control apparatus also assists in summoning the watchman while he is making his rounds and could not otherwise be signaled immediately. The advantages have been so great that it is intended to control the lights of another warehouse 300 yd. (270 m.) away by the same method and from the same office.

TEST REPORT FOR USE WITH INDUSTRIAL PLANT MOTORS

In Case of Repairs It Is Invaluable to Plant Electrical Engineers—Utilizes Tests Which Otherwise Might Be Wasted

Factory managers are realizing the importance of motor tests more and more, but unless the results are properly tabulated and kept up to date, the work is practically wasted. The accompanying tabulation sheet, which was drawn up by Lincoln, Hanson & Abbott, Inc.,


OVERALL TEST, H. P.

LOAD TOTALS, H.P.

Power Factor ——— Friction Load ——— Hour ——— A. M. P. M. Friction Loads ———

" " ——— Average Load ——— Hour ——— A. M. P. M. Average Loads ———

" " ——— Maximum Load ——— Hour ——— A. M. P. M. Maximum Loads ———

FUSE SYMBOLS

P--Edison Plug
C--Cartridge
L P--Edison Plug Large Size
C B--Circuit Breaker
O S--Oil Switch

Remarks:—

FIG. 1—OVER-ALL TEST IS RECORDED ON REVERSE SIDE OF CHART

534 Congress Street, Portland, Me., has been found to be especially valuable for reference in the case of repairs, breakdowns, etc.

In the carrying out of this system each motor in the shop is either painted in large white numbers or a number tag is placed upon it. This is preferable to distinguishing the various motors by manufacturers' numbers. When a motor drives a large number of machines the machines are listed under the common head "drives," and at the right of the sheet a note is made of the number of shafts, bearings and belts that are operated by the motor. This information is useful when considering the friction of the motor.

On the back of the sheet data covering over-all testing of the plant under various conditions are tabulated. The totals of the loads obtained on the front of the sheet for comparing with those taken on the back are tabulated. This company has made a large number of tests for various classes of business and has found that the information when complete is of extreme value in recommending changes and economies. In one shoe factory it was found that the total load of the motors was 185 hp., and when the operators left their machines, leaving only the main shafts and the countershafts in operation, that the load was 111 hp., showing that the working load outside of the friction was only 74 hp.

In another case it was found that a 50-hp. motor was carrying the load of nearly 85 hp. This was an old-style motor and probably underrated. In the same factory, a 100-hp. motor had a maximum load of 64-hp. and a friction load of 16 hp. In this particular case numerous changes were made which decreased the cost of power considerably and of course bettered the power factor.

E. S. LINCOLN.

Portland, Me.

MECHANICAL TROUBLES IN ELECTRIC MOTORS

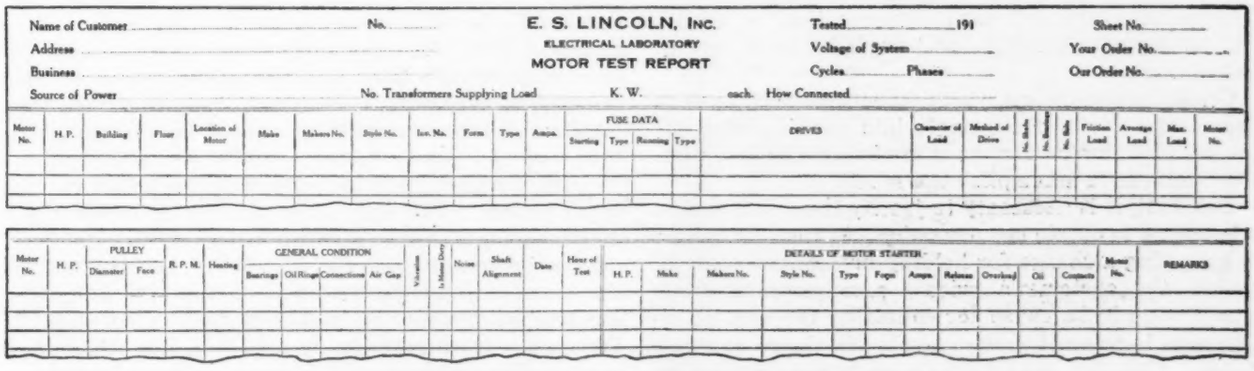
Some Causes of Bearing Failures, with Methods Which Have Proved Successful in Preventing Their Recurrence

Electric motor bearings must be thoroughly inspected at regular intervals if the electrical parts of the motor are to perform their proper functions. Regular split or solid bearings should be examined and oiled on an average about once a week. When the oil in babbitt bearings has turned black or the oil in bronze bearings has become bronze-colored it is usually a sign that the lubricant is very old or that the bearings have become unduly worn. In either case the bearings should be carefully examined and the oil renewed.

Cases are sometimes found where the operator believes that the bearing heating is due to the regular motor oil not being thick enough, and to reduce the heating vaseline or cup grease is used. These heavy lubricants work very well in some types of bearings, but where bearings are of the oil-ring type cup grease or vaseline will effectively stop the oil ring from turning, and as a result the bearing will soon burn out unless the motor is stopped and the bearing cleaned.

Tight belts are a very common cause of bearing-trouble. The remedy is usually a better mechanical drive. A belt drive should be as near horizontal as possible with the stack side of the belt on top. When this condition cannot be obtained, and especially when a squirrel-cage motor is driving high-speed machinery, large pulleys should be used. It is often necessary to change direct belt drives and to place a countershaft between the motor and the driven machine in order to get the proper relation of belts, pulleys and speeds.

HENRY W. ZEUNER,
Milwaukee Electric Railway & Light Company.


Name of Customer ..... No. .....
Address .....
Business .....
Source of Power ..... No. Transformers Supplying Load ..... K. W. ..... each. How Connected .....

E. S. LINCOLN, INC.
ELECTRICAL LABORATORY
MOTOR TEST REPORT

Tested 191
Voltage of System .....
Cycles ..... Phases .....

Sheet No. .....
Your Order No. .....
Our Order No. .....

Motor No.	H. P.	Building	Floor	Location of Motor	Make	Makers No.	Style No.	Ser. No.	Form	Type	Amps.	FUSE DATA Starting	Type	Running	Type	DRIVES	Character of Load	Method of Drive	No. Belts	No. Bearings	Size of Belt	Friction Load	Average Load	Max. Load	Motor No.

Motor No.	H. P.	PULLEY Diameter	Face	R. P. M.	Heating	GENERAL CONDITION Bearings	Oil Rings	Connections	Air Gap	Vibration	Is Motor Dirty	Noise	Shaft Alignment	Date	Hour of Test	DETAILS OF MOTOR STARTER H. P.	Make	Makers No.	Style No.	Type	Fuses	Amps.	Release	Overload	Oil	Contacts	Motor No.	REMARKS

FIG. 2—COMPLETE DATA ON MOTOR AND DRIVEN MACHINERY ARE KEPT ON THIS CHART

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Methods for Increasing the Use of Electric Light, Power and Heat

THE JUSTICE OF THE POWER-FACTOR RATE—I

Fairness of a Charge Generally Upheld, When Properly Evaluated and Justly Applied—Methods to Be Followed in Enforcing It

BY A. G. DARLING

The general tendency to inquire into the advisability of an enforced power-factor clause in power schedules has given rise to the investigation of the subject presented here.

The fairness of a charge (credit or debit) has generally been upheld when it is fairly evaluated and justly applied. Of the many schemes suggested for metering and billing, the one that will satisfy most of the usual schedule forms and eliminate opportunity for argument is the combination of the usual watt-hour and demand meter with the reactive volt-ampere-hour and its demand meter. Bad engineering and so a poor business policy may be sponsored by forcing all the customers to install condenser capacity after having done everything possible to secure high-power-factor apparatus properly applied. Coöperation between the producer and the user, as well as between users, will assist this situation materially.

Taking Phase Angle Into Consideration

The price of any commodity is recognized to increase with each change from its natural state. To generate electricity at a given phase, frequency and voltage costs a certain price, which is increased by each step in transformation, transmission and distribution. When the consumer is willing to pay for transformation from the high voltage that passes his door to a safe voltage for his plant he admits the justice of the differential. In like manner he may pay for the further transformation from alternating current to direct current. But it has been thought in the past unnecessary and hard to prove that he should pay for disturbing the natural angle between current and voltage.

Conditions in recent years have proved that it is necessary to take phase angle into consideration for the price of power. Demands are being made for suitable methods to accomplish the result.

But, first, it is necessary to justify the result before attempting to obtain compensation. If there is justice in collecting a charge for holding investment ready to satisfy the customer's private arrangements, there would seem to be cause for collecting the cost of investment to serve the consumer in his choice of phase angle. This has been held to be fair by the bodies intrusted with such matters.

To arrive at a fair price for displacing the relation of voltage and current is not such an easy matter to determine as some other factors affecting the rate for power. This is particularly true because of existing ratios, which must be changed to include the new factor. Some rate schedules recognize the existence of power factor and attempt to stipulate its limitations. Others place a value upon it but find it difficult to prove the conditions.

In all contracts some value of power factor has been included, for even though no thought were given to the subject, the power factor would then be unity. With a given power factor then as a starting point, it is necessary to evaluate the effects of any other power factor.

Lagging or leading current affects all apparatus through which it passes, and some other equipment, in addition, which does not actually transmit that current.

The effect begins with the distributing transformer at the customer's plant, going back through the distributing line, the main step-down transformers, the transmission line, the step-up transformers, generators and the attending equipment of exciters and voltage regulators. The prime movers are designed for certain true energy output. If the energy output of the generators is affected, the prime movers are called on to deliver more or less than their design admits.

Electrical losses occur in transmission which are affected by power factor. The generating, transforming, transmitting, distributing and regulating capacity of the plant are likewise affected. In discussing the effects of power factor on these elements it is necessary to realize that:

With an improvement in power factor those parts of the plant affected will have an increased ability to supply demand. Therefore the fixed charges on the released portion of the plant should be credited to the means of increasing the power factor.

Power Factor of Losses Varies with That of Load

With an improved power factor the value of the decreased electrical losses should be credited to the means of obtaining the power-factor improvement. It is worthy of note here that the power factor of the losses will vary with that of the load; therefore the losses under both conditions should be expressed in terms of the power factor established in the price. The plant capacity will increase with the power-factor improvement. The equivalent amount of power that may be sold, formerly used up in losses, less the loss on the increased capacity, should all be credited to the means of power-factor improvement. (In using the expression "means of power-factor improvement," the consumer, the power producer or any other person who accomplishes this result may be defined.) Conversely, it may be pointed out that a decrease in power factor should cause the power producer to be credited with all the factors that enter into the improvement of the power factor.

The conclusion reached from this viewpoint is that,

having established a point of value, credit must be given to the means of improvement and charges made against the means of detriment. On taking these factors into account and distributing them over the market it will be found that some consumers' conditions will allow them very profitably to correct their lagging power factor; with others there will be an even break, and still others will find the new rates a hardship. This means that the producer will find some of his customers considering other means of securing their power, particularly if each customer is left to solve his own problem. However, by giving the subject consideration, it may be found that this class of customer, individually or in groups, can afford to purchase sufficient corrective kilovolt-amperes at a cost below that for which they might produce it themselves. Or, considering this class in groups or one group of the whole, there may be opportunity for them to combine their forces in proportion to their needs, to the end that their investments and interests be pooled into one installation which would reduce the expense to all. Such an equipment might be placed in the producer's station, for which a space rental and operating charge can be made. This will not cure the distributing-line losses and capacity, which will then not be credited to the customers interested. It is not hard to conceive of instances where isolated condensing equipments in small sizes would not only be unprofitable but extremely poor engineering and bad business.

[In the second installment, to be printed in next week's issue, Mr. Darling will discuss factors that enter into a choice of metering equipment.]

USING LANGUAGE EMPLOYEES CAN READILY UNDERSTAND

Wage Increases Interpreted in Terms of Customers' Costs Help Employees to Assist in Educating the Public

A certain telephone company makes a practice of educating its employees in those phases of public utility operation which will assist them in upholding the company and its policies in any friendly discussion with neighbors and friends. As a part of this plan, the company recently told a girl who had received a $10 per month increase in wage just how many subscribers would have to pay an increased rate of 25 cents a month in order to provide funds for her increase in salary. This information evidently impressed the girl, for on the following morning the effect of the information thus imparted came back to the company's officers. It happened like this.

The girl chanced to live next door to one of the local newspaper editors. As they started for work at about the same time, he remarked that he "would probably have to take a fall out of her company in an editorial that day on account of the increased telephone rates." The girl in reply related the story of her increase in salary and told the editor how many subscribers had to contribute to it and also pointed out that many other employees of the company ought to receive more money. As a result of this experience the editor called at the telephone company's office to have a look at the real data in the case before he wrote his editorial. When he did write it the comment was very different from that which he had originally intended to make, and instead of a sweeping and one-sided condemnation of the telephone company for its increase of rates to customers the fact was recognized that rising costs of labor and material affect public utilities equally with others.

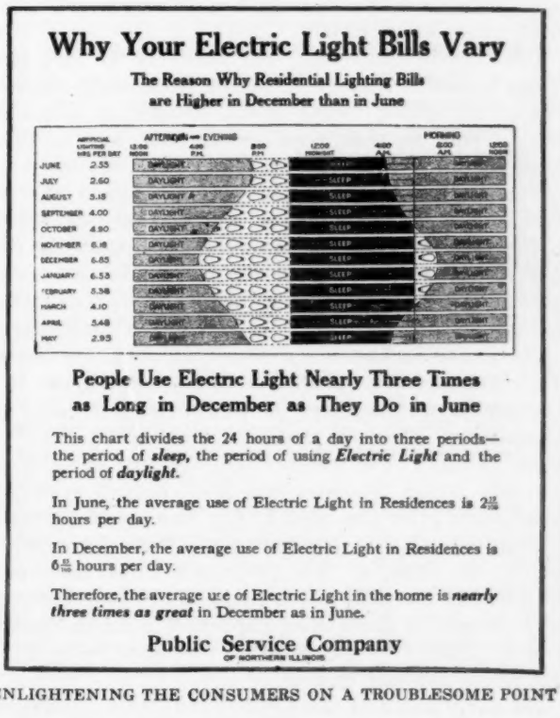
Executives of electric light and power companies who have heard of this incident see the possibility of an important application of the same principle within their own organizations. They see first that employees are particularly receptive to information on the company's cost of doing business at times when salary increases are being discussed. They also see that not enough use is being made of the employees as a means of disseminating correct information about the company's business and its problems. Some are taking steps to remedy the situation.

GETTING READY FOR THE AUTUMNAL COMPLAINTS

Central Stations, Realizing Marked Difference Which Fall Months and Change in Working Hours Will Bring, Prepare Customers

The Public Service Company of Northern Illinois is preparing to issue to its customers information like that shown in the illustration herewith. This is being circulated in two forms. One form is on print paper of ordinary weight measuring about 6 in. by 7 in., while the other is on bristol board measuring 9 in. by 11 in.

The former type of circular can be used for mailing as an envelope stuffer if folded once, while the latter is


Why Your Electric Light Bills Vary
The Reason Why Residential Lighting Bills are Higher in December than in June
JUNE 2.55
JULY 2.60
AUGUST 5.18
SEPTEMBER 4.00
OCTOBER 4.90
NOVEMBER 6.16
DECEMBER 6.85
JANUARY 6.53
FEBRUARY 5.38
MARCH 4.10
APRIL 5.48
MAY 2.95
DAYLIGHT
SLEEP
People Use Electric Light Nearly Three Times as Long in December as They Do in June
This chart divides the 24 hours of a day into three periods—the period of sleep, the period of using Electric Light and the period of daylight.
In June, the average use of Electric Light in Residences is 2 55/100 hours per day.
In December, the average use of Electric Light in Residences is 6 85/100 hours per day.
Therefore, the average use of Electric Light in the home is nearly three times as great in December as in June.
Public Service Company
OF NORTHERN ILLINOIS

ENLIGHTENING THE CONSUMERS ON A TROUBLESOME POINT

in a convenient form for posting on bulletin boards or tacking in conspicuous places.

Many companies thing it is particularly important that something be done this year to counteract the inevitable complaints of high bills that will come in the fall, since this year will bring a combination of the usual increase in fall lighting, together with an increase caused by the change in working hours.

WILL WAR-TIME PRICES DECLINE TO LOWER LEVELS?

After a Leap of 112 per Cent in the War Commodities Dropped 8 per Cent in Seven Months, Only to Increase Again

BY F. A. WARFIELD*

There has been a general belief that readjustment must bring with it a downward movement in the price level both of wages and materials. Many months have passed since the armistice was signed, but there is very little indication of prices going down. Let us see if we cannot get some light from the history of the past. Within the last sixty-five years five notable wars have been fought, not including the war just ended.

The Crimean War was fought during the years of 1854, 1855 and 1856 by England, France and Turkey arrayed against Russia. For eight years prior to its beginning the prices that were paid for commodities in England remained stationary. In the five-year period that followed they increased 43.1 per cent and at the end of 1870 were 6 per cent above those of the pre-war period.

The Franco-Prussian War was fought during the years of 1870 and 1871 between Germany and France. For the four years preceding the war there was very little change in the average commodity prices in either country. The end of the war found Germany victorious, prosperous and aggressive with its average price increase amounting to approximately 10 per cent, while in France, beaten and burdened with debt, prices five years after the war were still 6¼ per cent above those in effect at its inception.

The Spanish-American war occurred at that period of our economic history when the commodity price level was at the lowest figure in the history of index numbers. Prior to that time prices had been gradually dropping until the year preceding the war they were at the low level. Two years after the war the price level was 21 per cent above that of the year previous to the war, and after a drop of approximately 6 per cent it again started upward. In Spain the level of commodity prices four years after the war was 16 per cent above the level that obtained at its beginning.

The Russo-Japanese War was fought during the year of 1904 and 1905. For the three years prior to its commencement the prices in Russia as represented by a summary of sixty-six essential commodities had been slowly falling. The war brought a sharp upward turn, and this rising tendency was not checked until 1907, three years after the close of the war, when prices had reached a level of 23 per cent above that of the pre-war period. In 1910, or five years after the war, prices were still 12 per cent above those of the year before the war. Much the same thing happened to Japan, the price level of 1909, four years after the war, being 21 per cent above pre-war figures.

The early years of the Civil War in this country witnessed the same phenomenal rise in prices as has taken place during the last three years. In the year preceding the war the price level fell off approximately 12½ per cent, but at the end of 1864 it had reached a point of 178 per cent above the level of 1860. In the early part of 1865, the end of the war being in sight, wholesale prices took a sudden and violent break, dropping during the first six months of the year 27 per cent from the high level of 1864. Through the latter part of 1865 prices recovered until in 1866 they were but 16 per cent below the high level of 1864 and 162 per cent above the pre-war level. From this time (two years after the close of the war) prices gradually receded, but it was not until 1878, thirteen years after the close of the struggle, that the pre-war price level was reached.

Is it possible to ignore such an array of direct testimony, and can any of us in the light of these facts predict a quick return to the old price level? We often hear it said that it is the exception that proves the rule, but in this case there is no exception from which to draw any conclusions.

The main question to be answered from these figures and those of the present war is, will enonomic history repeat itself? Commodity prices reached their high level in October 1914. Up to March 1 the recession was less than 8 per cent, but in April commodity prices rose 1½ per cent, and they are still going up.

The trend of the times is toward further increases, and that the labor cost of the utilities will further advance, either by increase in the direct wage or by some such system of profit sharing as is being established by many large employers, is indicative that the ultimate return to normal conditions is not at hand.

It should be said that by normal labor conditions for the future I do not mean the identical conditions existing prior to the war, but refer to the conditions that would normally have been attained had war conditions not intervened.

An analysis of the United States Bureau of Labor statistics shows that the increase in the average wage paid per employee during the decade immediately preceding the opening of war in 1914 was 12 per cent. During the war period increases in wages in the operating departments have ranged from 25 per cent to 150 per cent, and in my opinion 75 per cent may be taken as the average increase occasioned by the war.

The actual increase in the various classes may vary from these figures, but it is plainly to be seen how abnormal are the sudden great increases which have come on account of the war. Under normal conditions, at the rate indicated by the growth during the ten years preceding the opening of the war, the utilities would be paying in salaries and wages about 20 per cent of their total operating costs, while because of war conditions they are paying from 35 to 40. Does any one of you believe that labor will give up this great gain?

What is the solution of the problem? We have all increased our rates, yet to the majority of us the desired result as indicated by the rate of return has not materialized. An increase in rates does not solve the whole problem. Getting a little extra money for the coming year does not remedy the underlying trouble. We have got to get in line with the economic principles that rule this world. We have got to let the public know that we have no superior ability over the rest of mankind, that we cannot do business successfully on fixed rates and rising costs. We have got to make the public realize and understand that while we are subject to regulation by municipalities, which other industries are not, and that while our rates are fixed by commissions and councils, while those of other industries are not, after all, in common with all industry, we enjoy one common burden, the tyranny of the balance sheet, a burden which none of us, regulated or unregulated, can escape.

*From a paper read before the Iowa Section, National Electric Light Association.

DIGEST OF ELECTRICAL LITERATURE

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Cores and Coils for Transformers.—ARTHUR PALMER.—A description of various windings used in modern transformer practice.—*Power*, Aug. 5, 1919.

Laminated Iron in Electric Motors.—M. S. HANCOCK.—The author indicates the care necessary in assembling iron sheets in the manufacture of laminated structures in motors.—*Electric Journal*, August, 1919.

Secondary Connections for Constant-Current Transformers.—L. ARNOLD.—The single-circuit connection possesses the advantage that no ground or combination of grounds can damage the transformer, while at the same time the line is insulated for full circuit voltage. The multi-circuit connection has certain advantages under normal operating conditions, but in case of unequal loading the voltage to ground may greatly exceed that for which the line was constructed, and in case of grounds it is possible to burn out one-half of the secondary winding.—*General Electric Review*, August, 1919.

Standardization of Steam Turbo-Electric Generator Sets.—The standardization rules given are those adopted provisionally by the Chambre Syndicale des Constructeurs de Gros Matériel Electrique and the builders of steam turbines of the Rateau type. They are published to encourage discussion with a view of standardization on a broader basis. The proposed standards for turbines are grouped under the main headings, technical and commercial, and cover the following items: (1) Technical—Power ratings; steam conditions; temperature of circulating water; dimensions of bearings, shaft ends, couplings, etc.; oil pressure; steam consumption and speed regulation; corrections for variations and conditions; tolerances, and responsibility for erection, etc. (2) Commercial—A model specification and agreement is presented to cover the technical requirements and the terms of payment and penalties, etc. Explanatory notes are added.—*Science Abstracts, Section B*, June, 1919. (Abstracted from *Rev. Gen. d'Elec.*, April 5 and April 12, 1919.)

Generation, Transmission and Distribution

Gas Versus Electricity.—ACH. DELAMARRE.—A brief in refutation of the conclusions too favorable to gas that Sir Dugald Clark drew recently before the Royal Society of Arts. If one considers only the thermal output of the combustible burned, the arguments of the English engineer are admissible, says the author; but on taking account of thermal economy the superiority of electricity for lighting and motor power, disregarding heating, is incontestable.—*Revue Générale de l'Electricité*, July 26, 1919.

Protective Value of the Earthed Reactive Coil at the Neutral Point of Alternating-Current Systems.—H. GÖRGES.—The author deals with Petersen's proposal to prevent the occurrence of excess voltages by earthing the neutral point through a reactive coil. The effect of this protective arrangement can readily be investigated by means of the author's method of topographical representation of alternating-current potentials. His general equations are for this purpose further amplified, and the formulas are then applied to the reactive coil-earthing arrangement. The treatment is entirely mathematical, and it is shown that for three-phase current the current at the earthing point will vanish when $3\omega^2 CL_0 = 1$, where L_0 is the inductance of the reactive coil and C the capacity interposed between each phase and earth. This special case is then considered more fully. It is shown that the maximum current passing through the earthing point is proportional to the relative losses in the reactive coil; this loss should therefore be made as low as possible. The presence of harmonics increases the value of the short-circuit current, and care should hence be taken that they are not prominent. The general equations and their application to single-phase currents are then considered. The author finally summarizes by declaring that the reactive earthing coil is a very simple method of reducing the current in the earth connection to a low value. It is unable to make it vanish completely, because it cannot be built so as to be loss-free, and also because harmonics in the supply voltage cannot be entirely eliminated. It is therefore necessary to expect a value several times greater than that which holds for current of a single frequency only. In extensive installations with very high voltages the earthing current can reach such high values that extinction of the arc cannot be expected. But the power appearing in the coil is so greatly reduced that even in such cases the reactive earthing coil has an important protective value.—*Science Abstracts, Section B*, June, 1919. (Abstracted from *Archiv f. Elektrot.*, Nov. 14, 1918.)

Installations, Systems and Appliances

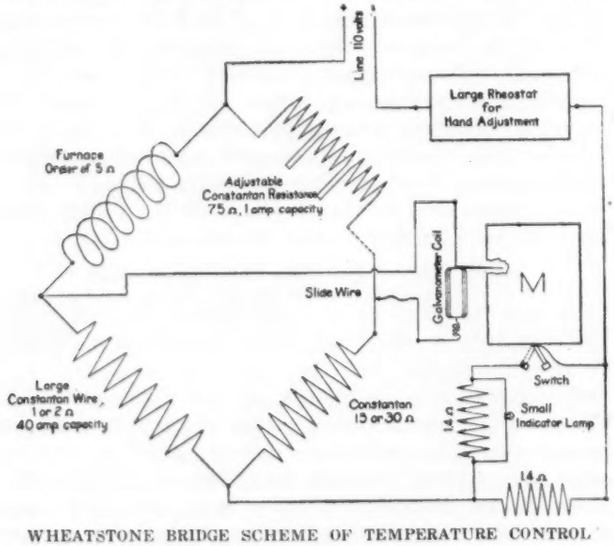
Radiometallography.—A discussion of the use of the Coolidge tube in detecting flaws in castings.—London *Engineer*, July 25, 1919.

Calculating the Windings of Electromagnets.—A. CURCHOD.—A mathematical article concerning the relations between the geometric dimensions of an electromagnetic winding and the field that it may develop. Formulas for the length of the wire of a coil, the diameter of the wire and the size of the coil for a fixed number of ampere turns are given.—*Revue Générale de l'Electricité*, July 19, 1919.

Suppression of Intermittent Earths by Neutral Resistance and Spark Discharger.—W. PETERSON.—Although the "intermittent ground" is the most important source of abnormal pressures in transmission systems, its action has only recently been elucidated and the protection at present provided in transmission systems against damage by intermittent earths is empirical and often inadequate. The first extinction of the arc estab-

lishes a steady high-voltage charge on the line, which causes the arc to strike again, thus incidentally producing dangerous voltages, but suppresses the latter at their inception. To get at the root of the trouble the high-voltage charge must be removed rapidly. This may be done in any of four ways—by spark discharger with damping resistance, by ohmic resistance permanently connected between phases and earth, by ohmic resistance between generator or transformer neutral and earth, and by the "earth coil." Earthing the neutral point through non-inductive resistance is the best of the first three methods, in that there is no waiting for a critical voltage to break down the spark gap, and no loss of energy as when the phases are earthed continuously. The neutral resistance must not be so low that the earth current becomes excessive nor so high that the discharge is dangerously delayed. Within half a period from the extinction of the earth arc the steady-voltage charge should be so much reduced that this voltage *plus* the phase voltage does not suffice to restrike the arc. The author shows that the first effect of the neutral resistance is to reduce the pressure of the charge. Discharge curves are given for various values of neutral resistance, and it is shown that with very low resistance the discharge is very rapid and no excessive voltages arise, but intermittent arcing occurs, the arc being restruck very rapidly at relatively low voltage. An earth coil develops conditions "at least twenty times more favorable than are attainable with neutral resistance."—*Science Abstracts, Section B*, June, 1919. (Abstracted from *Elektrot. Zeits.*, Aug. 29, 1918.)

A Furnace Temperature Regulator.—WALTER P. WHITE and LEASON H. ADAMS.—By making the heating coil of an electric furnace one arm of a Wheatstone bridge and combining this with a galvanometer regu-



WHEATSTONE BRIDGE SCHEME OF TEMPERATURE CONTROL

lator, thus keeping constant the resistance of the coil, one can, regardless of variations in the current supply and with no attention, maintain constant the temperature of furnaces not too directly influenced by the temperature of the room, or where the surrounding air is kept constant. The power available in this regulator is relatively very great; nothing has to be inserted within the furnace cavity, and the lag is practically nothing. The regulator is often almost at its best under conditions most unfavorable to other regulators. It has held a small furnace constant to 0.1 deg. for hours at temperatures from 500 to 1400 deg. C.—*Physical Review*, July, 1919.

Electrophysics and Magnetism

Residual Gases and Vapors in Highly Exhausted Glass Bulbs.—J. E. SCHRADER.—The investigation of high vacua has been extended by making observations on the effect of the sealing off of highly exhausted glass bulbs and noting the subsequent change in pressure with time over an extended period. On sealing off the bulbs and gages by melting that glass at a constriction there is a comparatively large evolution of gases and vapors which can be partly removed by pumping during the time of sealing off, but the pressure in the bulbs is always four or five times as large as the pressure before sealing off. —*Physical Review*, June, 1919.

Source of Ultra-Violet Radiation.—W. KASPEROWICZ. —A continuous ultra-violet spectrum is produced by the discharge of sparks between aluminum electrodes in water. Alternating current at 50,000 volts is used with a distance of 2 mm. between the electrodes, and distilled water must be used, as common water is too highly conducting. The water should be renewed by keeping it flowing. The characteristics of the spectrum obtained are detailed. This source of radiation has been used for a number of absorption tests, and it has been demonstrated that the absorption of benzol does not consist of bands but of series of bands. Furthermore, with benzol vapor a number of series of bands have been discovered in the extreme ultra-violet region, thus adding about forty new bands to those already known.—*Technical Supplement Review of Foreign Press*, June 24, 1919. (Abstracted from *Schweiz. Elektrot. Zeits.*, May 10, 1919.)

Units, Measurements and Instruments

Service Tests of Small-Capacity Heaters.—ARTHUR H. BRYANT.—Deals with schedules of tests and experiences as to errors.—*Electrical Review*, July 26, 1919.

Contribution to Galvanometry.—D. GERMANI.—Among the formulas established in the course on measurements conducted by M. Chaumat at the Ecole Supérieure d'Electricité, the author constructed a curve which gives the value of the "ballistic constant" in terms of the resistance of the galvanometric circuit, from which may be deduced the optimum resistance of this circuit for the measurement of inductive discharges.—*Revue Générale de l'Electricité*, July 26, 1919.

Telegraphy, Telephony and Signals

The Audion as a Circuit Element.—H. W. NICHOLS.—The functional equations for the three-element audion are used to deduce the actions taking place in any circuit containing the audion. The equations for small variations in the general network containing audions are developed and simple equivalent circuits to replace the tube are shown. Next the effects of the capacities between elements are worked out, and also some examples of amplifiers and oscillation generators.—*Physical Review*, June, 1919.

The Radiating Power and Dirigibility of Some Antennas.—W. BURSTYN.—The dirigibility of some forms of directive aërials is studied following the method of the "form factor," which is considered as being a function of the direction. The aërials are considered as composed of "dipoles" or are divided into a sufficient number

of elements, in each of which the current can be considered as constant, and therefore each of them as a dipole. This latter case is that of the single-wire antenna of a flying aëroplane, which antenna assumes the shape of an S approximately. The energy radiated by directive aërials in all the directions of space (and not only in the horizontal plane) is considered. The results are in accordance with those already known. The radiating powers are calculated starting from the radiating power of a dipole.—*Science Abstracts, Section B*, June, 1919. (Abstracted from *Jahrb. d. Drahtl. Tele.*, January, 1919.)

Measurement of Radio-Frequency Resistance, Phase Difference and Decrement.—J. H. DELLINGER.—The methods of measuring resistance and related qualities at radio frequencies are fewer in number and necessarily different from those at low frequencies. The conditions of such measurements and the relations of the various methods have not previously been given in comprehensive fashion. This paper shows the relations between resistance, phase difference, sharpness of resonance and decrement. The methods of measurement are derived and classified. Most of the valuable methods are comprised under the resistance-variation and reactance-variation methods. Special direct-reading methods of measuring phase difference and decrement are presented.—*Science Abstracts, Section B*, April 30, 1919. (Abstracted from *Inst. Radio Eng. Proceedings*, February, 1919.)

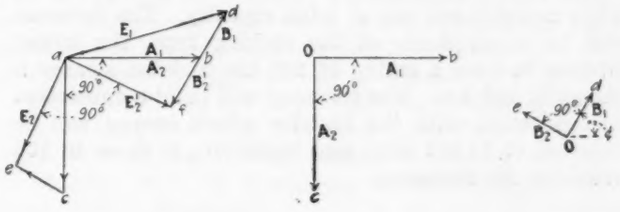
Unification of the Manual and Automatic Telephone Systems.—D. E. WISEMAN.—A description of the physical consolidation of the Bell manual and the Automatic Electric telephone systems of Los Angeles, Cal., which prior to June 1, 1918, operated as separate systems. While similar consolidations had been made previously, they included relatively small volumes of traffic and afforded no engineering precedents as a guide to the consolidation of the two systems serving 129,000 stations. The plans for the physical union of the two companies were devised by a joint committee of engineering representatives and contained a number of novel operating and construction methods which are described. Under the new system each subscriber has access to every other subscriber in the Los Angeles exchange and to all long-distance lines centering there. Where duplicate services were installed the subscriber was given his choice as to whether he would retain the manual or the automatic system, and about 12,500 duplicated were eliminated, the choice between the two being equally divided.—*Proceedings A. I. E. E.*, August, 1919.

Miscellaneous

Practice in Making Electric Utility Appraisals.—CHARLES W. MCKAY.—Practical methods are discussed for the inventory of land, buildings and outside plants. Systematic plans are discussed and forms are given for gathering data in the field.—*Electrical Review*, Aug. 9, 1919.

Is the National Electrical Safety Code Suitable for California?—EDWARD B. ROSA.—The policies of the Bureau of Standards in regard to the safety code as well as a possible code of ethics have been the subject of considerable discussion. In this article is a statement by the chief physicist of the Bureau of Standards in which he states the bureau's viewpoint and denies all intention of instituting a code of ethics or attempting the regulation of rates.—*Journal of Electricity*, July 15, 1919.

Asymmetric Polyphase Systems.—P. MULLER.—It is shown that asymmetric polyphase systems may be resolved into two symmetrical systems, in one of which the phases are in the same sequence as in the asymmetric system while in the other the phase sequence is reversed. A method is given for the resolution of two-phase and three-phase systems, and its application to asynchronous motors and phase transformers is illustrated. In an asymmetric polyphase system the vectors are of different magnitudes and not symmetrically spaced; hence it is necessary to consider each and every phase. Analytical investigation of this problem is tedious, especially when there is interaction between phases, as in polyphase asynchronous motors. The figure illustrates the resolution of an asymmetric two-phase system into two symmetrical systems. The



RESOLUTION OF ASYMMETRICAL SYSTEMS INTO SYMMETRICAL SYSTEMS

geometry of the method is proved in the original paper. E_1, E_2 are the vectors of the asymmetric system. E_2 is rotated through 90 deg. to position E_2; the points df are joined, the line between them being bisected at b and the latter point is connected to a. Then ab, bd represent the components A_1, B_1 of E_1, and ab, bf when swung back through 90 deg. represent the components of E_2. In other words A_1, A_2, B_1, B_2 are the desired symmetrical components of E_1, E_2. According to the angle at which they are combined, the systems AB yield various asymmetric systems. The ends of the vectors E_1 and E_2 (the latter being E_2 swung through 90 deg.) lie at opposite ends of a diameter of the circle described with center b and radius B. The direction of rotation of the asymmetric system is determined by the larger of the two vectors, A_1B. If $A = B$, then E_1 is at right angles to E_2 and E_2 is therefore opposite to E_1. In this special case we have a single-phase system produced by two polyphase systems rotating in opposite senses.—*Science Abstracts, Section B*, June, 1919. (Abstracted from *Elektrot. Zeits.*, Aug. 29 and Sept. 5, 1918.)

Determination of Inductive Consumption.—F. BUCHHOLZ.—It is becoming increasingly important that electricity tariffs should take into account the power factor of the load supplied. The difficulty is to determine with sufficient accuracy the mean power factor for the period between meter readings. The author investigates the theoretical basis of the problem and concludes that not the mean power factor alone but the product of this with the "correlation factor" (which yields the "energy factor") is the quantity which should be measured and made the basis of the tariff. Formulas are given for the "mean power factor," and the fallacy of the usual definition is discussed.—*Science Abstracts, Section B*, June, 1919. (Abstracted from *Elektrot. Zeits.*, March 6 and 13, 1919.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ELECTRIC BRASS FURNACES FOR THE PACIFIC COAST

Oregon Brass Works Will Make Initial Installation at Portland of Two Furnaces with Ratings of 300 Kw. and 150 Kw. Respectively

The Oregon Brass Works, Portland, Ore., will immediately install what is said to be the first electric brass furnace on the Pacific Coast.

The initial installation will be two furnaces, one of 1-ton capacity and one of ½-ton capacity. The furnaces will be single-phase, of the rocking type, the larger furnace to have a rating of 300 kw. and the smaller a rating of 150 kw. The company will build a substation in connection with the foundry where energy will be received at 11,000 volts and transform it down to 100 volts for the furnaces.

BROADER POWERS URGED FOR TRADE COMMISSION

Victor Murdock, Testifying Before Judiciary Committee of House of Representatives, Seeks Authority to Regulate Voluntary Organizations

Victor Murdock, member of the Federal Trade Commission, urged before the judiciary committee of the House of Representatives on Monday of this week that the power of the commission over business corporations and organizations be vastly extended.

Mr. Murdock suggested amendment of the commission law and the Clayton anti-trust act to provide for regulation of voluntary trade organizations. He named as among the organizations which would be affected by the legislation recommended the American Iron and Steel Institute and the Institute of American Meat Packers. He told the committee that other trade associaions had been formed and were operating in violation of the general movement toward lower prices in the coal, shoe, textile, clothing and various industries.

Business practices which the commission wants to break up if the laws are amended were enumerated as follows: Guarantees against price declines to jobbers by manufacturers; commercial bribery of employees or officials of one company by other companies to obtain business; the breaking of contracts to sell spot on a rising market; fraudulent and illegal bond and stock issues.

In asking for powers to act against voluntary combinations of large business firms, Mr. Murdock said that many of these organizations had been developed to such power that competition had been eliminated.

"The organizations are so intact that nobody is discriminated against—that is nobody except the public," he added, "and the commission has no power to act when there is no complaint by other firms. The trouble is that these associations have taken in practically the entire industry."

The amendment suggested by Mr. Murdock follows:

Whenever from any investigation authorized to be conducted under this act the commission shall have reason to believe that any person, partnership or corporation engaged in commerce has been or is in its organization, business conduct, practices or management violating the anti-trust acts, or that the same will substantially lessen competition or tend to create a monopoly, it shall issue and serve upon such person, partnership or corporation a complaint stating its charges in that respect, and shall proceed in reference thereto in all respects as provided in Section 5 of this act.

If upon hearing the commission shall be of the opinion that the method of organization, business conduct, practices or management is prohibited by the anti-trust acts, or that the same will subsequently lessen conditions or tend to create a monopoly, it shall make a report in writing in which it shall state its findings as to the facts and shall issue its order to cease and desist, or to readjust its organization, business, conduct, practices or management as ordered.

CHAIRMANSHIP OF TWO OF THE N. E. L. A. COMMITTEES

President Ballard Announces that S. M. Kennedy Will Head Committee on Service and Lee H. Newbert Committee on Co-operation in the Industry

President R. H. Ballard of the National Electric Light Association has received from S. M. Kennedy, general agent of the Southern California Edison Company, Los Angeles, his acceptance of the chairmanship of the committee on service and from Lee H. Newbert, Pacific Gas & Electric Corporation, San Francisco, his acceptance of the chairmanship of the committee on coöperation in the industry. Both of these important committees will pursue lines of original investigation and will make reports along constructive lines to the national convention of 1920.

Mr. Kennedy's committee will work on the conditions of service from this viewpoint: With the regulation of rates and finances by state utility commissions to provide only safe returns on capital invested, and with a courageous attitude of these regulating commissions to see that such return is allowed, electric utility companies are entirely out of politics and can devote their energies to the service of the public without any encumbrance to the highest achievement. Mr. Kennedy is well known in the national forum of the industry both as a progressive official and a writer. Among his writings that have attracted much favorable notice in the industry are "Courtesy as an Asset" and his more recent contribution, "The Man in the Street."

Mr. Newbert's committee will endeavor to formulate and submit to the next convention a plan by which all of the branches of the electrical business may coöperate and to show specifically how this plan can be practically worked out in the geographic sections. Mr. Newbert

has been very active in the California electrical co-operative campaign, of which he has for several years been chairman. This movement had its origin in the Pacific Coast Section, has met with remarkable success in the centralization of central stations, manufacturers, jobbers and contractor-dealers, and has demonstrated that they can work together for the general good of the industry. Chairman Newbert in appointing the members of his committee will make selections from all branches of the industry.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS

Reconstruction Convention to Be Held at Springfield, Mass., on Oct. 13 and 14—Discussion to Promote Safeguarding of Electrical Hazards

The National Association of Electrical Inspectors will hold a reconstruction convention on Oct. 13 and 14 in the Municipal Auditorium, Springfield, Mass. The program will consist of a number of "forums." The subjects will concern personal accident and fire hazards. They will be for the single purpose of explaining how electrical hazards may be safeguarded and will be open to discussion by any who may attend. For this reason a general invitation is extended to the allied electrical interests. The Hotel Kimball will be the convention headquarters. Ladies will be invited to attend the banquet, which will be held Monday evening, Oct. 13.

Following is the tentative program:

1. Opening of the convention, Allen W. Hopkins, past-president Western New England Section, N. A. E. I.
2. Welcoming the convention, Arthur A. Adams, Mayor of Springfield.
3. Response of the convention, Washington Devereux, president National Association of Electrical Inspectors.
4. "The Beginnings of the National Electrical Code," by F. Elliot Cabot, the first chairman of the electrical committee.
5. "Radio Developments and Their Relation to the Code," by Clarence D. Tuska, associate member I. R. L.
6. "Electrical Inspections and the Electrical Contractor," by Gilbert S. Smith of Philadelphia; "Electrical Inspections and the Power Company," by Percy H. Bartlett, engineer of installations, Philadelphia Electric Company; "Electrical Inspections and Their Value to the Fire Insurance Interests," by Ralph Sweetland, secretary of the electrical committee and assistant secretary New England Insurance Exchange.
7. "Some Code Problems of Present Interest," by Dana Pierce, chairman of the electrical committee and vice-president of the Underwriters' Laboratories.
8. "Insulating Joints: What of Their Future?" by Joseph C. Forsyth, chief inspector of the New York Board of Fire Underwriters, New York City.
9. "High-Potential Wiring," by George C. Lawler, electrical engineer, Associated Factory Mutual Fire Insurance Companies, Boston, Mass.
10. "The National Electrical Safety Code," by Dr. Morton G. Lloyd, electrical engineer, Bureau of Standards, Washington, D. C.
11. "A Uniform Type and Design of Attachment Plugs and Connectors: Is Such a Device Needed and Is It Possible to Achieve?" (Speaker to be announced.)
12. "Polarization and Protective Grounding," by W. J. Canada of Stone & Webster, Boston.
13. "Interbuilding Service Connections," by Hubert S. Wynkoop, past-president N. A. E. I., Bureau of Gas and Electricity, New York City.
14. "The Visual Marking of Fuses," by Thomas Henry Day, past-president N. A. E. I., Hartford, Conn.
15. There will be a session of the association for members only in the Hotel Kimball on the morning of Oct. 15, the room and hour to be announced during the convention.

All of the sessions save that last mentioned will be open to all engaged in the application of electricity, and free discussion is urged.

The program committee hopes that the ladies who may accompany the delegates will feel free to attend the convention, more especially during the opening exercises.

A. I. E. E. CONVENTION WILL MEET AT LOS ANGELES, CAL.

Eighth Annual Pacific Coast Convention to Be Held Sept. 18 to 20 with Important Technical Sessions and Social Features

The eighth annual Pacific Coast convention of the American Institute of Electrical Engineers will be held in Los Angeles, Cal., Sept. 18-20, under the auspices of the Los Angeles Section. The program as arranged by the local committees insures important technical sessions as well as many pleasant social features.

The technical papers will be as follows:

1. "California 220-kv., 1100-mile, 1,500,000-kw. Transmission Bus, by R. W. Sorensen, professor of electrical engineering, Throop College of Technology, and H. H. Cox and G. E. Armstrong of the Southern California Edison Company.
2. "Predetermination of Synchronous Phase Modifier Performance," by Hubert V. Carpenter, dean of mechanic arts and engineering, State College of Washington, Pullman, Wash.
3. "Theory of Probabilities Applied to Failures of Suspension Insulators," by L. M. Klauber of San Diego Consolidated Gas & Electric Company.
4. "Order and Amplitude of Harmonics in Voltage Wave Forms with Indicating Instruments," by Leslie F. Curtis, assistant professor of electrical engineering, University of Washington.
5. Symposium on operating difficulties. This symposium will consist of a number of valuable short papers from many sources, covering various operating troubles.

The entertainment committee promises a splendidly arranged program to be announced at the convention, of special interest to ladies, who are cordially invited to attend.

VERMONT ELECTRICAL ASSOCIATION TO MEET

After Two Years of Suspension on Account of the War, Companies of the Green Mountain State Are to Get Together

The annual meeting of the Vermont Electrical Association will be held at Lake Dunmore, Vt., on Sept. 18 and 19. This is the first time in two years that the association has been able to get together, and it is hoped that a large representation will be registered.

The first day will be spent on routine business, problems of the development of energy in Vermont and timely discussions. The second day will be set aside to renew old acquaintances, and the clambake promises to be good.

C. C. Wells of Middlebury, Vt., is president; E. E. Larabee of Bennington is vice-president, and A. B. Marsden of Rutland is secretary-treasurer.

NEW CONSTRUCTION WORK ON SAN JOAQUIN SYSTEM

Program of Development Is Urged with All Possible Speed to Provide More Facilities—Kerckhoff Power House of 30,000 Kw. Rating

BY L. J. MOORE
Electrical Engineer San Joaquin Light & Power Corporation

The construction program for 1919-20 of the San Joaquin Light & Power Corporation, Fresno, Cal., has now taken quite definite form, and the work is being carried on with all possible speed. A new hydroelectric plant of 30,000 kw. rating, to be called the Kerckhoff power house, is being constructed. This plant will be ready for operation, it is hoped, early in 1920. The accompanying map shows the work, which is on the main San Joaquin River near Auberry, about 40 miles (60 km.) northeast of Fresno.

A dam 100 ft. (30 m.) high, which will back up the water in the river as high as is safe with respect to the company's power house No. 1, is to be constructed at the point indicated on the map. There will be available a pondage capacity of 3000 acre-feet (3690 cu.m.) in the reservoir above the dam, which can be used by the plant to carry peaks. The dam will be a combination of the constant angle-arch type and gravity section, with a crest length of about 430 ft. (130 m.), 360 ft. (109 m.) of which will be spillway controlled by Tainter gates. It will be capable of discharging floods up to 100,000 cu.ft. (2800 cu.m.) per second of water. The site is in the bottom of a narrow box canyon, and it is necessary to lower all material for construction down an incline from the rim of the canyon, which is about 1100 ft. (335 m.) higher than the dam. This incline has a maximum grade of 102 per cent over part of its length.

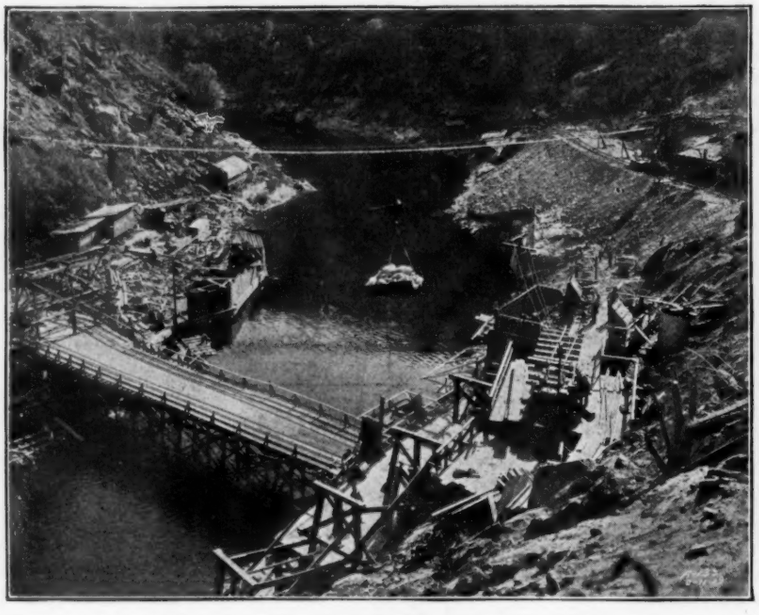


FIG. 1—DAM SITE OF KERCKHOFF DEVELOPMENT, SHOWING CONCRETE MIXING PLANT IN OPERATION

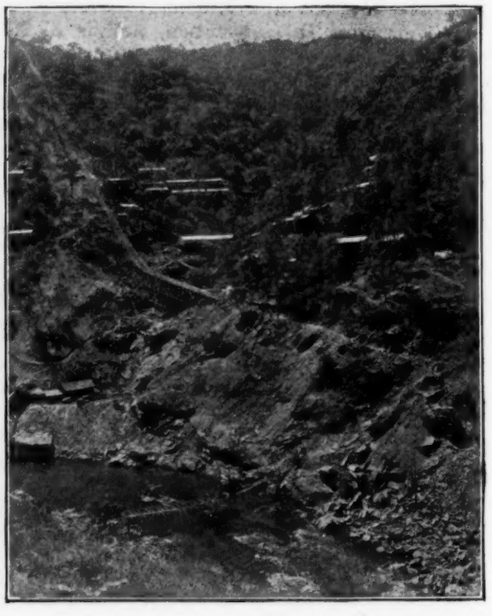


FIG. 2—INCLINE AT THE DAM FOR POWER HOUSE, DURING CONSTRUCTION

Approximately 16,950 ft. (5180 m.) of tunnel, 17 ft. by 17 ft. (5 m. by 5 m.) in cross-section, will be built to carry the water to the power house. The "muck" from the tunnel is being loaded into cars by steam shovels with short booms and dipper sticks. A double track is laid on the floor of the tunnel. One track is standard gage, for the shovel which loads the "muck" into dump cars on a light track beside the first. Direct-current electric mine locomotives haul the loaded cars out of the tunnel. The tunnel is through solid granite and will be left unlined. It is intended to deliver 1500 second-feet (42 cu.m. per sec.) of water.

At the south portal of the tunnel connection will be made to three steel penstocks tapering from 8 ft. (2.4 m.) to 7 ft. (2.1 m.) diameter, with a short 6-ft. 6-in. (2.25-m.) section at the bottom to connect to the turbines. A surge tank will be provided at the head of the pipes, as well as a trap for catching small rocks, etc.

The power house will contain three vertical 15,000-hp. turbines, operating under a maximum static head of approximately 350 ft. (106 m.). The tunnel will be under pressure, the 350 ft. representing the total head above tailwater of the water in the dam. The generators will be 14,200 kva., at 80 per cent power factor, and will generate at 6600 volts. Two separate water-wheel-driven exciters will be provided, each being large enough to excite the three generators.

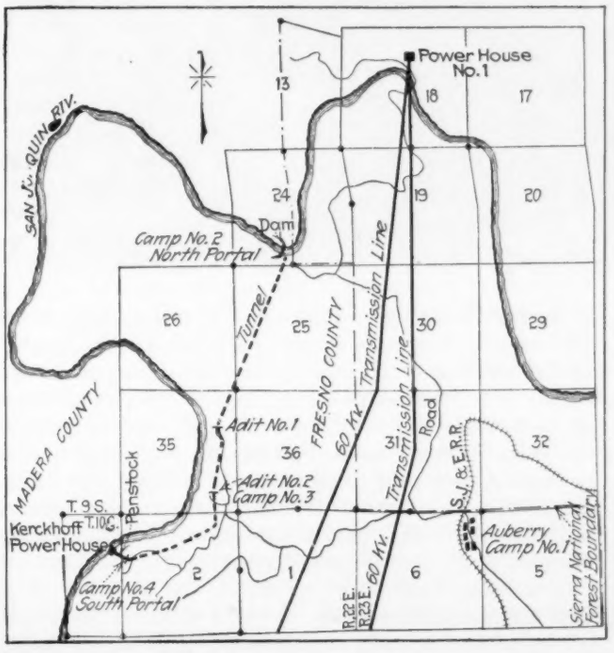
The low-tension buses and switches will be placed inside the building, but all the high-tension switching equipment and the step-up transformers will be placed out of doors. The transmission voltage will be such as to deliver 110,000 volts at the nearest substation, about 30 miles (48 km.) away.

The transmission line to connect this power house to the present transmission system of the company will be about 130 miles (209 km.) long. It will consist at present of one three-phase circuit of 266,800-circ. mil aluminum on a 10-ft. (3-m.) spacing, and strung on 60-ft. (18-m.) wood poles. The standard span for straight-away work will be 587 ft. (179 m.), and 200-ft. (60-m.) spans will be used over railroads. This line appears practicable for California interior valleys, where no snow or ice is experienced and temperatures below 20 deg. Fahr. seldom if ever occur. The wire will be strung with a tension to give a minimum clearance of 28 ft. (8.5 m.) above ground at a temperature of 120 deg. Fahr. (34 deg. C.).

It is expected some time in the future to bring the

output of the company's other San Joaquin River plants into the Kerckhoff power house at the present transmission voltage of 69,000, and there step up to the new voltage of 110,000. A second transmission line can then be built paralleling the one now under construction. Suitable relay protection will then be provided to sectionalize in case of trouble and interruptions to the service thus be prevented.

Three step-down substations of 15,000 kva. each will be built. There will be provided auto-transformers for



lowering from 110,000 kw. to 69,000 kw., and the new line will be tied to the present system through them. Separate windings in the transformers will provide the usual 11,000 volts for distribution.

As other plants are added to the system they will be brought in at 110,000 volts. That system of transmission will be extended and the present 69,000-volt system of the company will become a sort of secondary transmission system.

NEWBURYPORT COMPANY INCREASES ITS RATES

Production and Other Costs Materially Greater than Last Year Force the Company to Make a Change in Schedule

The Newburyport (Mass.) Gas & Electric Company announced an increase in rates Sept. 3 owing to the additional cost of production.

A new lighting rate of 16 cents a kilowatt-hour, with a discount of 10 per cent for payment within twelve days, is established, the former rate being 15 cents, with 2 cents discount for prompt payment. A net increase of 1.4 cents therefore results. A new schedule of power rates, with a lower maximum, is declared. This runs from 7 cents net per kilowatt-hour for the first 200 kw.-hr. per month, five steps leading to a minimum of 2.2 cents net per kilowatt-hour for consumptions above 10,000 kw.-hr. per month. The former power schedule ranged from 8.5 per cent net for consumptions up to 100 kw.-hr. to 2 cents above 150,000 kw.-hr. The net increase is about 10 per cent.

To a representative of the ELECTRICAL WORLD J. Lee Potter, manager of the company, stated that rising costs have hit the company all along the line and tha' operations at the generating plant illustrate the adverse conditions encountered. These, of course, do not cover all the cost increases which determine the proper rate.

In the year ended June 30, 1919, the company generated 12,384,864 kw.-hr., at a manufacturing expense of $156,575, or 1.26 cents per kilowatt-hour. In the preceding year the output at the station bus was 8,905,-320 kw.-hr., the manufacturing cost being $105,144, or 1.18 cents per kilowatt-hour. In 1918 it was possible to obtain New River coal, and 10,900 tons were burned, whereas in 1919 only about half the fuel was New River and the quantity consumed was 14,750 tons. The average cost of coal per ton burned in 1918 was $8 against $8.39 this year. By careful handling of the plant, together with increased output, the coal consumption per kilowatt-hour was reduced this year from 2.74 lb. to 2.66 lb. Station wages rose in the two years from $10,208 to $19,654.

CONVENTION OF GENERAL ELECTRIC DISTRIBUTERS

Jobbers and Officials, Meeting at Association Island, Discuss Selling Methods, Advertising, Foreign Trade Conditions and Other Subjects

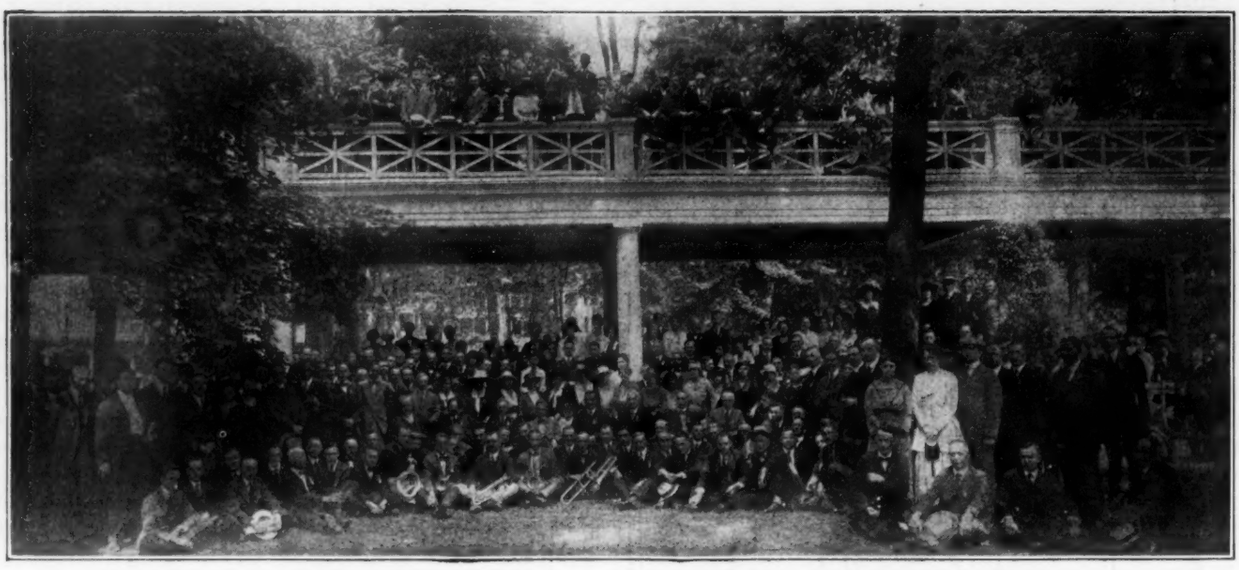
With their camp named in honor of Dana Bullen, manager of the supply department of the General Electric Company, 130 General Electric distributing jobbers and officials of the General Electric and associated companies held an all-week meeting at Association Island, Henderson Harbor, N. Y., Sept. 2 to 6 inclusive.

At the opening session on Tuesday, presided over by Frank Bernardin, B-R Electric Company, Kansas City, short addresses were made by Mr. Bullen and by A. D. Page, Edison Lamp Works.

Wednesday's meeting was given over to merchandising and advertising topics. With Major H. C. Houck in the chair, talks were given by W. L. Goodwin and J. A. Corcoran on selling methods and the present appliance opportunity, and Frank H. Gale discussed "Advertising Coördination."

C. W. Appleton, attorney for the General Electric Company, opened Thursday's program with a talk on foreign-trade conditions. A. D. Page and C. C. Osborn, Edison Lamp Works, described the new lamp-packing methods, and C. M. Bunnell discussed opportunities for selling automatic and miniature lamps. T. J. McManis told how the advertising of the Edison Lamp Works is analyzed and studied with a view to increasing its effectiveness. Dr. S. E. Doane, National Lamp Works, Cleveland, emphasized the value of the new foot-candle meter as an aid to increased lamp sales.

On Friday W. J. Reagles talked on art and advertising; George Hughes, president Edison Electric Appliance Company, Chicago, told of plans for improving appliance service; Julius Tuteur, president Electric Vacuum Cleaner Company, Cleveland, told of conditions observed during his trip to England, France, and Germany in the summer; A. J. Francis, Fort Wayne Works, discussed the sale of fractional-horsepower motors by distributers; F. W. Hall of the Sprague Electric Works talked on conduit sales, and R. E. Russell, Schenectady, described plans for promoting the sale of tungar rectifiers.



PENNSYLVANIA ASSOCIATION IN PEACE-TIME CONVENTION

Enthusiasm and Good Fellowship Displayed at Twelfth Annual Meeting at Bedford Springs—President Sproule Urges Fairness to Employees

The Pennsylvania Electric Association (state branch of the National Electric Light Association) met in its twelfth annual convention at Bedford Springs, Pa., on Wednesday, Thursday, Friday and Saturday of last week. Being a peace convention, euthusiasm and good fellowship prevailed. This was due not only to the work of the program committee in arranging for interesting and practical papers but to the very efficient work of the entertainment and exhibition committee. The latter, with the hearty support of the electrical manufacturers, provided a self-contained exhibit in a tent on the hotel grounds which was one of the attractions at the convention.

The program comprised reports of the committees, addresses by Thomas Sproule of the Philadelphia Electric Company, president of the association; William D. B. Ainey, chairman of the Public Service Commission of Pennsylvania, and W. H. Johnson, vice-president of the National Electric Light Association, and the following papers: "Economical Boiler-Room Practice for Medium-Size Plants," by Henry B. Bryans, Counties Gas & Electric Company, Norristown, Pa.; "Power-Factor Correction by Means of the Static Condenser," by O. C. Roff, General Electric Company, Philadelphia; "Increasing the Capacity of Existing Lines," by E. C. Stone, Duquesne Light Company, Pittsburgh,; "The Story of the Insulations," by C. E. Skinner, Westinghouse Electric & Manufacturing Company, East Pittsburgh; "The Isolated-Plant Costs as Influenced by the War," by John W. Meyers, Philadelphia Electric Company, Philadelphia; "Method of Operating a Meter Department in Scattered Territory," by E. H. Tyson, Lehigh Valley Light & Power Company, Allentown, Pa.; "The Effect of the War on Boiler-Room Practices," by John A. Barnard, Philadelphia Electric Company, Philadelphia; "Selecting a Switchboard for a Plant of Moderate Size," by G. E. Wendle, Lycoming Edison Company, Williamsport, Pa.; "Management and Men," by H. P. Weaver.

Mr. Sproule in his address was most optimistic about the outlook. He said the industry was called on to furnish power whereby 40 per cent of the munitions of the country were produced in Pennsylvania without governmental assistance. Moreover, forty-four companies with a total of 7549 employees contributed 1336, or about 20 per cent, to the forces of the army and navy. He deprecated the tendency toward group or class consideration of factors governing the employee, because such a machine-like consideration of labor tends to lack interest and efficiency. He maintained that it was important, however, to give employees fair and just treatment and that welfare work must go on in the industry along lines distinct from charity.

It was Mr. Sproule's impression that owing to the demand for labor, which will be almost as great as the war-time demand, the electrical industry will be called on to meet the inducements by other industries in order to keep their organizations intact. Moreover, as labor unrest spreads very rapidly through similar lines of work it will be necessary to exert every effort to prevent the electrical industry from becoming involved. Mr. Sproule warned his hearers of the activity of the Bureau of Standards and said that the effect of some of the proposed changes of the National Electrical Safety Code with reference to overhead-line construction would be to increase the cost of such work to an unwarranted extent. He suggested that the state association should coöperate with the national body so that the interests of the industry would be conserved.

In his general recommendations President Sproule urged that the activities of the Pennsylvania Electric Association committees should supplement the work of the N. E. L. A. committees. He recommended that standing committees study the effect of public utility commission rulings, the publications issued by the Bureau of Standards and the many publications, rules and regulations issued by state and municipal bodies, all of which have a tendency to recommend the development of the electrical industry.

Mr. Ainey in his address treated of post-war problems and the necessity for their proper solution. Mr. Johnson dwelt on the enlarged scope of the work of the geographic sections.

Officers were elected as follows: President, W. R. Kenney, West Penn Power Company, Connellsville, Pa.; first vice-president, Henry Harris, United Electric Light Company, Wilmerding, Pa.; second vice-president,

E. H. Davis, Lycoming Edison Company, Williamsport, Pa.; treasurer, H. S. Cantlin, Lehigh Valley Light & Power Company, Allentown, Pa.; members of the executive committee, W. E. Long of the Philadelphia Electric Company, J. H. Shearer of the Penn Central Light & Power Company, Altoona, and G. M. Gadsby of the West Penn Power Company, Pittsburgh. Henry N. Muller, Duquesne Light Company, Pittsburgh, was elected to fill the unexpired term of Henry Harris.

ACTIVITY IN ENGINEERING CONSTRUCTION PROJECTS

Large Contracts Are Taken by Stone & Webster, and This Organization Sees Bright Outlook for World-Wide Expansion in Business

Since April 1 contracts for new construction totaling about $20,000,000 have been taken by Stone & Webster, Boston, and the outlook for a world-wide expansion of business is believed to be bright by this organization. About $6,000,000 will be invested in electric lighting and power facilities, about $8,000,000 in industrial developments and $6,000,000 in miscellaneous enterprises. Stone & Webster have been asked to investigate and submit proposals on projects fast taking shape that will require an expenditure of at least $25,000,000.

Among the more important contracts in America are included a 40,000-kw. hydroelectric plant for the Great Western Power Company in California, involving about $4,500,000; a new steam generating station for the Hartford (Conn.) Electric Light Company, representing about $2,500,000; a million-dollar factory building for a subsidiary of the United States Rubber Company at Indianapolis, and a million-dollar machine-tool factory for the Whitman-Barnes Company of Chicago.

Japanese interests have asked Stone & Webster to undertake a hydroelectric development involving about $5,000,000; a dock development in the Mediterranean requiring about $11,000,000 is being investigated, and engineers of the organization will shortly proceed to Greece in connection with a five-million-dollar hydroelectric project in the vicinity of Saloniki.

MUNICIPAL HYDROELECTRIC PLANT CURTAILS SERVICE

Drought Compelled Marquette to Cut Off Waterworks and Other Motor Loads—Cleveland Cliffs Iron Company Supplied Service

"Unless copious rains fall within the next few days, Marquette will have electric service available only for essential night lighting, and there will be no day service whatever until the drought breaks," said Charles Retallic, manager of the Marquette (Mich.) electric light and power plant, to a representative of the ELECTRICAL WORLD on Monday of this week.

There has been practically no rain in the district for about sixty days, and it was calculated that the storage on the Dead River, where the hydroelectric plant is situated, would be used up by Friday, Sept. 12. After that time, said Mr. Retallic, there will probably be sufficient water to supply restricted lighting from 6 p.m. to midnight, provided that the plant is shut down entirely during the other eighteen hours of the day. The Cleveland Cliffs Iron Company has agreed to help by supplying service from 11.30 p.m. to 6 a.m.

The Cleveland Cliffs Iron Company and all other operators of hydroelectric properties in this section of the country are also suffering from a shortage of water. However, most of the private companies have developed water power in excess of their requirements and have built steam reserve plants besides. The city of Marquette was not so well prepared and it consequently had to discontinue service to the city waterworks, the electric railway company and to some of its other large industrial customers at the beginning of this week.

The Marquette waterworks and some other large power users have started up old steam plants, but the great majority of power customers are without power of any kind. The Cleveland Cliffs Iron Company is supplying up to 200 kw. of water-power service at its regular rates and will supply steam-generated energy if Marquette will pay the increased cost of steam generation. The City Commissioners have authorized the light and power department to investigate the possibility of developing additional power on the Dead River. However, engineers who are familiar with conditions on the river believe it would be better to install an auxiliary steam plant.

ISSUE OF $2,500,000 NOTES BY ROBBINS & MYERS COMPANY

Manufacturers Will Use Proceeds of New Issue to Retire Floating Debt—Plant Capacity to Be Increased 50 per Cent

An issue of $2,500,000 of 6 per cent notes of the Robbins & Myers Company, Springfield, Ohio, has been offered by Kissel, Kinnicutt & Company, New York, and the Maynard H. Murch Company, Cleveland, to yield from 6 to 6.35 per cent. The notes are dated Sept. 1, 1919, and mature $500,000 annually, on Sept. 1, 1920 to 1924. They are redeemable on any interest date prior to maturity upon thirty days' notice as a whole or in blocks of not less than $500,000 (in which event the company must call for redemption notes of one or more of the series last maturing) upon payment of a premium of one-fourth of 1 per cent for each six months between the date of redemption and the date of maturity, with a minimum redemption of one-half of 1 per cent.

In addition to this issue the company has outstanding $2,395,000 out of $2,500,000 authorized preferred stock and $1,250,000 of $2,500,000 authorized common stock. Net sales in 1919, partly estimated, are stated at $9,000,000. In 1918 they were $6,961,076 and in 1917 $5,758,335. Proceeds of the notes will be used in reduction of floating debt. Average net earnings for the six years ended Dec. 31, 1918, before federal taxes, amounted to five and one-third times and for the calendar year 1918 amounted to over eight times the largest annual interest requirements on the notes. Based on earnings of the first six months of 1919, the estimated earnings for the year before federal taxes will amount to ten times the largest annual interest requirement. Net earnings for 1918 after federal taxes amounted to over five times and estimated net earnings for 1919 are nearly seven times the largest annual interest requirements.

C. E. McGilvray, president Robbins & Myers Company, says in his letter to the bankers that the company has recently purchased adjoining property with buildings which will increase its capacity 50 per cent.

PENSION SYSTEM FOR SOUTHERN CALIFORNIA

Company Will Execute and Deliver Definite Legal Contract to Every Employee—Terms of the Arrangement for Payment

Under the pension system adopted by the Southern California Edison Company a definite contract will be executed and delivered to each permanent employee. The contract, conceived by President W. A. Brackenridge, approved by the directors and, as stated elsewhere in this issue, ratified by the California Railroad Commission, establishes the principle of pension compensation as a matter of legal contract. It assures the employee who fulfills the reasonable obligations of the service that it will be paid when the time of retirement arrives as a matter of right, collectible by law. It is not regarded as a charity.

The chief features of the contract, with an interpretation by the company of the reasons for their adoption, are in substance as follows:

Not only the employees of the Southern California Edison Company but those of all the subsidiary companies are included in the plan.

Male employees reach the age of retirement at sixty years, female at fifty-five, when they have been in the continuous service of the Edison company or any of its subsidiary companies for twenty years immediately preceding retirement.

The following scale applies to those who can be retired before serving twenty years: Men sixty-one, women fifty-six, who have served continuously nineteen years; men sixty-two, women fifty-seven, in service eighteen years; men sixty-three, women fifty-eight, service seventeen years; men sixty-four, women fifty-nine, service sixteen years; men sixty-five, women sixty, service fifteen years.

The monthly pension allowance is based upon the average monthly compensation the employee received during the five years' period of employment when the compensation was the greatest, computed in this manner.

Two per cent of the first $200 monthly compensation, 1½ per cent of the next $300, 1 per cent of the next $500, 0.75 per cent of the next $1,000 and 0.5 per cent of all such average monthly salary above $2,000. The figure or sum thus determined is multiplied by the number of years of service immediately preceding retirement, and the sum thus determined shall be paid the retired employee until death. No payment, however, shall be less than $25 per month.

DISABILITY BENEFITS ALSO PROVIDED FOR

A disability benefit is provided for employees who have been in the service twenty years, and who become disabled in any manner, upon the recommendation of the pension committee, approved by the president and the board of directors or the finance committee. There is also a clause giving the management some latitude to grant disability benefits to those disabled who have not served the full twenty years.

The period over which the disability benefit shall extend is to be determined and fixed by the pension committee, and all of the terms and conditions of the disability benefit may be changed from time to time in the discretion of the committee, with the approval of the president and the board of directors or the finance committee, but in no case shall the disability benefit exceed 50 per cent of the salary at the time the benefit is granted. The disability benefit, however, is not like the pension, and does not become a liability of the company.

Five employees of the company are to constitute a "pension committee." They are to be appointed by the president of the company with the approval of the board of directors, and will make recommendations on service and other matters.

PENSIONS FOR EMPLOYEES APPROVED IN CALIFORNIA

State Railroad Commission Formally Indorses Plan of Southern California Edison Company Allowing Inclusion of Cost in Operating Expense

Pension systems maintained by California utilities for the benefit of employees who have given of their best years to the service and find their earning capacity waning through old age meet with the approval of the California Railroad Commission. In a letter to the Southern California Edison Company the commission has voiced its approval of the plans of that company and its subsidiary corporations to take care of faithful workers. Not only does the commission approve the plan, but it makes it possible by declaring that "the commission will consider the proper cost of the execution of this plan as a proper charge as to operating expense."

The question of cost was the motive which led to the filing with the commission by the Southern California Edison Company of a petition asking for approval of the plan to pension aged employees and to allow the cost as part of the company's operating expense.

The approval covers the pension plans of the following companies: Southern California Edison Company, Mount Whitney Power & Electric Company, Santa Barbara Gas & Electric Company, Santa Barbara Suburban Railway Company, San Joaquin & Eastern Railroad Company and Huntington Lake Hotel Company, all of which are interconnected.

WASHING-MACHINE MAKERS HAVE MEETING IN CHICAGO

Program Includes Discussion on Financing Time-Payment Sales, Larger Payments Down and Shorter Periods on Time Payments

Methods to assist the trade in financing time-payment sales, larger payments down, shorter periods on time payments, statistics of the industry and the advisability of giving or not giving premiums with retail sales were among the topics discussed at the meeting of the American Washing Machine Manufacturers' Association at Chicago on Wednesday and Thursday of this week.

All through the meeting there was a noticeable interest in the dealers' problems, more than one manufacturer showing that he had traveled among the dealers to learn their problems and get their point of view. The business sessions were enlivened by a talk by Capt. H. W. Eden, formerly of the Brokaw-Eden company, who told of his personal experiences in the army. Others

who spoke on the first day were H. A. Lewis, *Electrical Merchandising*, on "Statistics of the Electrical Industry;" W. B. Paul, Federal Finance Company, Indianapolis, on "Time-Payment Financing," and Roy B. Wooley, Society for Electrical Development.

THE PASADENA PLANT IS A PUBLIC UTILITY

California Railroad Commission Decides that When City System Went Outside of Municipal Limits It Became Subject to Regulatory Law

When the city of Pasadena, which operates its own electric light and power plant, went outside the territory defined as the city of Pasadena and sold electrical energy to the Raymond Hotel and other customers in the city of South Pasadena, it became, as other public utilities, subject to the jurisdiction of the California Railroad Commission. So declares the commission in an opinion handed down in the case of the Pacific Light & Power Corporation against the two Pasadenas. Accompanying the opinion is an order directing the city of Pasadena immediately to file with the commission its schedule of rates.

The case was presented to the commission through the medium of an agreed statement of facts, the question at issue being solely one of law. The Pacific Light & Power Corporation serves electrical energy in the city of South Pasadena. When its field was invaded by the municipally owned Pasadena plant it appealed to the commission, setting up the contention that in going beyond the limits of Pasadena the municipality had placed itself in the same category as privately owned utilities. The city responded with the claim that the use of the words "private corporation" in the state constitution in describing utilities precludes the Legislature from vesting in the Railroad Commission any jurisdiction with reference to utility operations of municipalities. Disposing of this claim by quoting from the state constitution and the public utilities act and Supreme Court decisions, the commission says:

> These decisions clearly hold that when a municipality engages in a public utility business, certainly in so far as extraterritorial service is concerned, the municipality is to be regarded as acting in the capacity of a private corporation or individual and is subject to the same obligations and enjoys the same rights, in so far as its own public utility operations are concerned, as a private corporation or individual engaged in such a business.
>
> We believe the conclusion irresistible, therefore, that the city of Pasadena, in supplying a public utility service to the inhabitants of the city of South Pasadena, must be regarded as coming within the phrase "private corporation and individual or association of individuals" as that phrase is used in Section 23 of Article XII of the constitution, specifically defining certain public utilities to be subject to regulation by the Railroad Commission. It is our conclusion also that this service clearly comes within the definition contained in the public utilities act itself.

Power Bills a First Lien

The Nassau Electric Railroad Company informed Judge Mayer of the United States Circuit Court this week that it was unable to pay bills aggregating $528,880 owed to the Brooklyn Rapid Transit Company for electrical energy supplied in the last seventy-five days. Judge Mayer ordered the receiver to have all bills for power accrue as a first lien against the property. He directed Receiver Lindley M. Garrison and counsel to present on Sept. 22 a plan for a permanent solution.

Electric Club of Chicago Enjoys Itself at Its Annual Outing

Every effort was made to make the eleventh annual outing of the Electric Club of Chicago enjoyable for the wives and children of the members, and the committee in charge succeeded admirably. There was a bountiful supply of prizes, which ranged from a two-way plug to an electric washing machine, and there seemed to be something for nearly everybody. Ravinia Park was again the scene of the event, and many stayed to enjoy the opera in the evening.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Continuation of War Rates.—In denying an application of the Public Service Company of Northern Illinois for permission to continue in effect advanced rates for electric power the Illinois Public Utilities Commission decided that it would not authorize a continuation of advanced emergency rates, necessitated by war, upon a return to more stabilized conditions, except upon clear and satisfactory showing that the increases are justified upon a very tangible and definite basis. It also held that contributions to war charities cannot be considered as part of the operating expenses of public utilities in the determination of reasonable rates. The federal income tax is not a part of the operating expenses of public utilities, the commission said.

Competitive Plant Disapproved.—The New York Public Service Commission, Second District, has denied the application of the village of Schenevus, Otsego County, for authority to build and operate an electric lighting plant in the village and in the town of Maryland. The village has been supplied by the Great Bear Light & Power Company, which generates energy at East Worcester. It was proposed to build a transmission line of about 10 miles and obtain energy from the Southern New York Power Company, paying 4½ cents a kilowatt-hour. The evidence as to the cost and prospective earning power of the proposed new plant, was found by Commissioner Frank Irvine, who wrote the opinion, to be exceedingly meager. The cost of the system was estimated at $22,000. The village, relying on this estimate, voted bonds. There was no detailed study of construction costs and no study at all apparently of operating costs. The commission determined the economic features of the case, showing the cost per kilowatt-hour as 26 cents. Commissioner Irvine says: "It is quite evident that 26 cents a kilowatt-hour in such a community is a prohibitive price. If sold for less, the deficit would have to be concealed in an increased burden of taxation. In determining to plunge into this adventure without any real consideration of the construction costs and without any consideration at all of operating costs, it is evident that the village was swayed by its temper rather than its judgment. The commission is therefore called on to protect the village against itself. Public convenience and necessity do not require a village to embark on a disastrous enterprise." Representatives of East Worcester claimed that if Schenevus was permitted to install its plant East Worcester would be deprived of electric service as it is manifest that the Great Bear company could not subsist on the patronage of East Worcester alone. The commission held that it was proper for it, representing the entire public, to bear this feature in mind. Evidence given by Schenevus at the hearing before Commissioner Irvine was almost entirely directed to prove bad service by the Great Bear company.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

California Association of Electrical Contractors and Dealers.—This association held its monthly meeting in San Francisco on Aug. 29.

Toledo Chapter, A. A. E., Installed.—Major Garrison Babcock, U. S. A., formally installed the Toledo Chapter of the American Association of Engineers at a recent meeting.

Engineers' Club of San Francisco.—"The Engineer in Modern Life, His Needs and Ideals," was the subject of a talk given by F. H. Newell at the Aug. 26 meeting of the club.

Public Utility Commissions to Meet in Indianapolis.—The National Association of Railway and Utilities Commissioners will hold its thirty-first annual convention in Indianapolis, beginning on Oct. 14.

Convention of Northwest Electric Light and Power Association Postponed.—Instead of being held from the 10th to the 13th, the convention of the Northwest Electric Light and Power Association will take place from Sept. 24 to 27 in Seattle, Wash.

Massachusetts State Association of Electrical Contractors and Dealers.—A meeting of the Boston section of this association will be held on Sept. 18. Alfred J. Hixon will make a report on the Milwaukee convention of the National Association of Electrical Contractors and Dealers.

A. I. E. E., Pacific Coast Convention.—The Pacific Coast convention of the American Institute of Electrical Engineers will take place in Los Angeles, Cal., from Sept. 18 to 20 and will be under the direction of the local section. Vice-president John B. Fisher is to preside at the sessions of the convention.

New Headquarters for A. A. E.—The national headquarters of the American Association of Engineers will be at the Nepeenauk Building, 63 East Adams Street, Chicago, within the next two or three weeks. The old quarters of the association at 29 South La Salle Street are to be occupied by the Chicago chapter, which has now 1100 members.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Insulation of Power Conductors.—Where there is uncontroverted testimony that it is not possible to insulate power wires so as to prevent injuries, a judgment based on negligence with respect to insulation cannot be sustained, especially where it was not shown that the power company had knowledge, actual or constructive, of the defects causing an injury, or that but for such defects the accident would not have occurred. (Robertson vs. Rockland Light & Power Company, 176 N. Y. S. 281.)

Custom of Other Employers.—The custom of others engaged in like business is not the absolute test of negligence in failing to provide safe working-place appliances, but where the master was conducting his business in accordance with the uniform custom of others it devolves upon servant to show that custom is negligent. The presumption is that persons in like business are reasonably prudent, according to the Commission of Appeals of Texas (212 S. W. 656). It is also pointed out in this connection that an experienced employee, familiar with an unfenced exciter in an electric power plant and fully appreciating danger of injury from contact with it while in operation, assumes the risk. Nor is a servant relieved of the assumption of risks of a known defect by reason of a promise to remedy unless he continues in the service in reliance on such promise and has reasonable grounds to expect its fulfillment.

Insulation of Pole Conductors.—It is the duty of an electric light and power company to exercise due care to maintain proper insulation of its conductors, strung a few inches above the limb of a tree, so that they will not become dangerous to an employee of the park department engaged in trimming the tree, and such care includes continuance of inspection of the insulation to prevent decay and impairment. The test to be applied to an electric light and power company to determine whether it should have foreseen that a trimmer in the employ of the park department of the city might use as support a limb of a tree three-fourths burned through because of a cable of defective insulation strung above it is whether a person of ordinary intelligence, fully acquainted with all the circumstances, might have foreseen such conduct by the employee performing the duties of a tree trimmer. (Olim vs. New York & Queens Electric Light & Power Company, 176 N. Y. S. 370.)

Ohio Farmers Using Electrical Energy.—According to reports from the Ohio Public Utilities Commission, many applications have been made by farmers recently for authority to organize companies to finance transmission lines from city plants into the country districts. The energy is used largely in lighting homes, barns and other buildings and in operating agricultural machinery.

America Growing Less Careless.—An advance summary of mortality statistics for 1917 received by the National Safety Council from the Bureau of the Census indicates that as a result of the accident prevention movement the total of accidental deaths in the death-registration area of continental United States during 1917 was 53,544, as against 60,072 during the previous year. The report shows that the greatest number of deaths charged to any one accidental cause—11,114, or 14.8 per 100,000—was for falls. The rate for this cause varies but slightly from year to year. Machinery accidents caused 2112 deaths, or 2.8 per 100,000, a rate materially greater than that for any preceding year covered by the bureau's mortality records.

Geological Survey Plans to Study Power Resources.—Experts in the power resources division of the Geological Survey are directing their attention toward informing the public of the necessity of a source of cheap power. The coal situation, particularly, and transportation problems have emphasized the urgency of developing water-power resources, they point out. The last sundry civil bill included a provision to the effect that a commission should be named to investigate the advisability and feasibility of establishing a trunk transmission line to supply electric power to a large portion of the industrial region of the East from Washington to Boston. The provision of the sundry civil bill was eliminated by the committee, but the same provision will be included in the draft of the sundry civil bill to be presented next year.

International Trade Conference Plans.—Twenty thousand business men have been invited by the executive committee of the International Trade Conference to attend the meeting called by the Chamber of Commerce of the United States at Atlantic City, Sept. 31 to Oct. 3 for the purpose of conferring with delegates from England, France, Italy and Belgium about plans for the restoration of commerce. The committee in charge of this program, under the chairmanship of John H. Fahey of Boston, has laid down the general lines on which the conference will be held. The proceedings will be divided and time allotted in accordance with the importance of the various subjects to be brought up, numbering about twenty in all. After the conference the foreign delegates will make a short tour, visiting leading industrial centers as guests of the Chamber of Commerce of the United States.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

New Japanese Wireless Station.—A wireless station for exclusive military use is to be built this year at Kamishi, a town in the Ishikawa prefecture, facing the Japan Sea.

Department of Standards for Great Britain.—Premier Lloyd George has written to the English newspapers outlining several plans in addition to those which he announced recently before the House of Commons as constituting the program of the government. One proposal is to establish a Department of Standards, to promote and assist standardization in technical trade matters, which Premier Lloyd George regards as increasingly important to British industry. Another point is legislation to secure adequate measures permanently to protect the public from the harmful effects of trusts and combinations, should such protection become advisable.

National Safety Council Meeting.—Some of the most important problems before American industry to-day, such as the anticipation of labor unrest, increasing plant efficiency and production, decreasing manufacturing costs and the whole subject of labor management, will be discussed in connection with the general subject of accident prevention at the eighth annual safety congress of the National Safety Council in Cleveland, Oct. 1 to 4. The council has adopted the following slogan for the congress: "We have fought to make the world safe for democracy, let us now work to make industry safe for humanity." There will be four general sessions, four round tables and thirty-five sectional meetings during the congress. There will be three meetings each of the metals, mining and steam-railway sections, one meeting each of the marine and navigation and textiles, and two meetings of each of the following sections: automotive, cement, chemical, construction, electric railway, health service, packers, paper and pulp, public safety, public utilities, rubber, woodworking and women in industry. The first general session will be devoted entirely to a discussion of employees' representation under the following sub-heads: "Coöperation and Industrial Progress," "Labor Management and Collective Bargaining," "Practical Aspects of Employees' Representation and Employees' Representation from the Standpoint of Organized Labor." Arthur Williams, president Safety Institute of America, is one of the nominees for election as director at the meeting.

Columbus Strike Does Not Affect Power and Light.—The strike of motormen and conductors of the Columbus (Ohio) Railway, Power & Light Company is not affecting the power and light department. It was agreed that energy should be furnished for these purposes.

"Get the Story Across."—In a letter to members of the Society for Electrical Development James M. Wakeman, the general manager, tells briefly what is being done to give publicity to the industry and how the various society activities are rendering service. He asks the members to help "get the story across" to more men in the industry so that they will know what the society is doing. "Printed matter alone won't do it," says Mr. Wakeman. "The assistance of our members is needed to tell it. The staff tells it, but the number they can reach is comparatively small. If all our members would tell it, the society's activities would quickly become known and efforts at duplication cease."

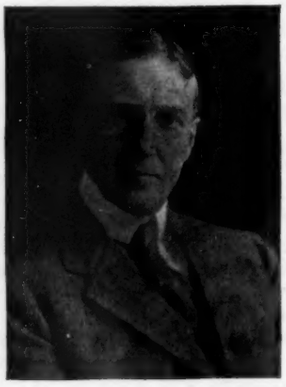
Water-Power Development in France.—The French government has submitted a bill to the Chamber of Deputies providing for development of the Rhone River for the generation of electrical energy, organization of the transportation facilities and irrigation. Cost of the developments projected is estimated at 2,500,000,000 francs. It is proposed to erect twenty hydroelectric power stations. The construction work would require fifteen years. It is proposed to grant a concession for this undertaking to a company with a capital of 250,000,000 francs and the privilege of issuing bonds to ten times that amount. These bonds would be guaranteed by the state and the state would appoint two-fifths of the membership of the administrative council, including the president.

To Pay Standard Dividends.—Directors of the Standard Gas & Electric Company have decided to liquidate the accumulated dividends of about 13 per cent on the preferred stock by issuing common stock at par to stockholders. A statement by the company says: "The operating statement for the first six months of 1919 shows the full 4 per cent preferred dividend earned with 3.52 per cent earned on the common shares, including the increased common stock to be issued in payment of the 13 per cent accumulated dividends on the preferred. This is a yearly rate of 8 per cent on the preferred and more than 7 per cent on the common, without taking into consideration earnings of the Shaffer Oil & Refining Company, which the directors state is progressing most satisfactorily. Earnings of the Standard company for the first six months of 1919 follow: Earnings after deduction of operating expense and estimated federal taxes, $1,377,011, less interest charges of $486,645; balance, $890,365, less preferred dividends of $443,961, leaving a surplus for the six months of $446,404. Directors have declared the regular quarterly dividend of 2 per cent on the preferred stock.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

F. C. Pratt, who was recently elected vice-president of the General Electric Company, was graduated in 1888 from the Sheffield Scientific School, Yale University, and, aside from certain outside work on investigations and design of special machinery, was employed from 1888 to 1906 by the Pratt & Whitney Company of Hartford, Conn. During that time Mr. Pratt was engaged in engineering and administrative work and held the positions of foreign sales manager, sales manager, secretary and vice-president of the company. A considerable portion of each year from 1891 to 1900 he spent in Europe in connection with the company's foreign business. In 1906 Mr. Pratt accepted the position of assistant to E. W. Rice, Jr., then vice-president of the General Electric Company in charge of engineering and manufacturing. Mr. Pratt had direction of the layout and construction of the Erie Works of the company until they were turned over to a permanent organization. He is an associate member of the American Institute of Electrical Engineers, a member of the American Society of Mechanical Engineers and a member of the late munitions standards committee at Washington, as well as a chevalier of the Legion d'Honneur and vice-president of the Yale Engineering Association.



F. C. PRATT

A. M. Dudley, who for a number of years has held the position of engineer in charge of alternating-current motor design of the Westinghouse Electric & Manufacturing Company, has recently been promoted to the position of engineer in charge of automotive equipment design of that company. The work which he now directs includes the design of starting motors, lighting generators and ignition apparatus for automobiles, wind-driven generators for wireless telephone and telegraph outfits on aëroplanes, and apparatus of a like nature. Mr. Dudley is a well-known authority on the design of windings for alternating-current motors and has added many valuable contributions of a practical engineering character to the literature which pertains to this subject.

C. H. Johnson, chief engineer in charge of power stations of the Columbus (Ohio) Railway, Power & Light Company for the last two years, has resigned to take a position with the Combustion Engineering Company, New York City.

W. M. Andrew, formerly associated with the Canadian Westinghouse Company, has been appointed general secretary of the Canadian Electrical Supply Jobbers' Association and of the Canadian Associated Manufacturers of Electrical Supplies, with offices at 206 Stevenson Building, Toronto, Canada.

B. A. Behrend, who has been appointed chairman of the A. I. E. E. technical committee on electrical machinery, is an electrical engineer of more than national prominence. As consulting engineer Mr. Behrend has been identified with many important achievements, including much work in which he has pioneered the way to advanced engineering practice. One of the most interesting of these electrical achievements was the linking together at Montreal in 1901 of the power from the Lachine Rapids, the Montreal Light, Heat & Power Company and Shawinigan Falls, 80 miles from Montreal. Ralph D. Mershon designed the 60,000-volt transmission line from Shawinigan Falls to Maisonneuve, Mr. Behrend designing the frequency-changing apparatus at Maisonneuve, linking successfully together for the first time three great power stations operated by different types of prime movers. He was born near Chillon Castle, Canton de Vaud, Switzerland, May 9, 1875, and in the nineties came to this country as chief engineer of the Bullock Electric Manufacturing Company. Later he became chief electrical engineer of the Allis-Chalmers Company, the electrical department of which he established and organized, and also served as consulting engineer with Allis-Chalmers-Bullock, Ltd., of Montreal. Before coming to the United States Mr. Behrend held the position of assistant chief engineer of the Oerlikon Company of Switzerland. In 1904 the United States Steel Corporation reconstructed all its power houses belonging to the Carey furnaces of Homestead, the American Steel & Wire Company of Cleveland, the Illinois Steel Company of South Chicago and the Indiana Steel Company of Gary, Ind., utilizing furnace gas for the operation of giant gas engines. The entire electrical planning of these installations, involving for the first time in this country the successful solution of the problem of parallel operation of gas engines, was in Mr. Behrend's hands and was completed without the usual method of trial and error, all the plant operating in multiple perfectly. The development of the turbo-generator with cylindrical cores and radial slots was due to Mr. Behrend, all American manufacturers now using the type which he developed in 1902. The theory of the induction motor as first presented by him in 1895 and the theory of the regulation of alternators as presented by him in 1896-1897 have long been generally adopted, and the rules of the standards committee of the A. I. E. E. conform to his recommendations, based on his theoretical and experimental work. At the end of 1908 he was called by the Westinghouse reorganization committee to Pittsburgh to redesign the electrical machinery and types of the Westinghouse Electric & Manufacturing Company. He has remained consulting engineer for that organization in connection with similar work. His achievements secured for him the gold medal of the Louisiana Purchase Exposition at St. Louis in 1904 and the John Scott medal of the Franklin Institute, Philadelphia, 1911. He is author of "The Induction Motor—Its Theory and Design" (1900, in French 1902, in German 1903); "The Debt of Electrical Engineering to C. E. L. Brown" (1901); "Engineering Education" (1907), and many monographs on the theory of alternating currents, motors and generators in American and European publications. He is a fellow and past vice-president of the American Institute of Electrical Engineers, fellow of the American Academy of Arts and Sciences and the American Association for the Advancement of Science, member of the American Society of Mechanical Engineers, American Society of Civil Engineers, Engineers' Club, Boston, and Engineers' Club, New York.

B. A. BEHREND

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

ALUMINUM-CONDUCTOR MARKET FIRM WITH LARGE SALES

Wire Quoted at 37½ to 38½ Cents per Pound F. O. B Manufacturer's Works, Depending on Size and Quantity

The price of aluminum ingot is firm at 33 cents per pound f.o.b. manufacturer's works. Aluminum in the form of wire for electrical conductors varies with the size of wire, quantity, etc. It also varies with the size of steel reinforcement, it being understood that most of the high-tension transmission lines now using aluminum employ a composite cable, the center strand or core being a high-grade galvanized plow steel and the outer strands aluminum.

The price of aluminum wire may be quoted at approximately 37½ cents to 38½ cents a pound f.o.b. manufacturer's works, depending on size and quantity. The composite price, including the price of steel, depends entirely on the relative cross-section of both metals. The principal manufacturer of aluminum electrical conductors reports a firm market with several large sales, both domestic and foreign.

ARGENTINE MARKET FOR ELECTRICAL SUPPLIES

American Batteries, Carbon Brushes and Fans Find Better Sales, with English, German and Italian Products Showing Closest Competition

Argentina probably buys more electrical equipment than any other South American country, according to P. S. Smith of the Bureau of Foreign and Domestic Commerce, and following are some notes on his findings in this market:

Dry batteries have a good market, especially for door-bells, annunciators and automobile ignition. American makes sell well. The Hellesens, a Danish cell of high quality, is the keenest competitor.

Storage batteries and wet batteries follow the European custom. The types are English "Tudor" or German "Accumulatoren Fabrik." Where these are used all repair parts naturally must come from those nations.

The railroads and government use large numbers of Leclanché and sulphate-of-copper cells for telegraph circuits. In 1918 alone the government needed 70,000 rubber jars and 100,000 elements.

Carbon brushes of various sizes and grades have always a good demand, because nearly all the central stations furnish direct current. The power circuits are nearly all of 220 volts or 440 volts. The government uses a great many carbons. Carbons are used now only for projectors of motion-picture theaters, the use for arc lamps having rapidly diminished. The supply formerly came from Germany.

The only conduit used extensively is Bergmann tubing.

Doorbells formerly came from Germany because of the low prices at which they could be sold, but American makes are now seen on the market. Buzzers are very little used.

Electric fans, both the ceiling and desk type, are popular. Oscillating fans of 12-in. and 14-in. sizes are the best sellers. There is relatively little sale for fans for home use, for the evenings are generally cool. The Italian fan is the chief competitor, because it sells on price rather than quality. Where formerly German, English and American fans were sold, American fans now are preferred.

There is very little sale of flashlamps. Very few people know much about household devices, such as vacuum cleaners and laundry machinery. Very cheap wooden and porcelain push-buttons are the only ones now enjoying any extensive sale.

Theatrical apparatus is generally poor and old-fashioned. This field might be a good one if aggressive agents were put to work, but correspondence will accomplish nothing.

Portable tools should find a ready sale.

HEAVY BUYING EXHAUSTS ELECTRICAL SHEET STEEL

Entire Production of 1919 Sold Out and Orders Are Taken for Early 1920 Shipments at Prices to Be Set Later

The sale of electrical sheet steel for transformers, magnetic cores, motors, generators, etc., has progressed to such an extent that production for the remainder of the year has already been booked to entire capacity. Consequently word has gone out from the mills to book no more for 1919 delivery. This is going to leave some regular customers with short supplies, but with sufficient warning issued manufacturers of the sheets did not feel that they could keep their books open to accommodate customers who were slow and hesitant in their ordering.

There are certain grades of steel, not so commonly used, on which deliveries have increased up to about nine weeks, and the tendency here too is to lengthen shipments.

One mill is booking orders for the first quarter of 1920 only at the prices which shall prevail at that time. There has been no price change for this commodity since March 21, but it is expected that in a few weeks this mill will be able to anticipate and quote a price on which it will book orders for early 1920 delivery. There is no assertion that there will be an advance, but the tendency is in that direction. At this time the outlook is not very promising for lower steel prices in 1920, as the steel workers have called a strike for Sept. 22 against the United States Steel Corporation, which they say can be prevented only by a compromise by the corporation.

Word comes from one mill, however, that it is not selling electrical sheets for shipment next year, and it is not prepared to make any statement with respect to prices for 1920.

OUTLOOK FOR ELECTRIC RANGE BUSINESS GOOD

Although Production Is Much Heavier than Ever Before, Still It Will Be Difficult to Fill All Requirements

BY C. A. FLINT

Sales Manager Rathbone-Sard Electric Company, Inc., Aurora, Ill.

The electric range business "looks good" this year. A study of conditions first hand in thirty-nine states shows a great deal of enthusiasm. The central stations seem to be opening up with regard to extensions and seem to be disposed to take this business wherever it is offered, in a great many cases without regard to cost of line extensions or transformer equipment. The practice this year seems to be to sell a range at list price connected, provided that the estimated gross income over a period of two years will equal or very nearly equal the cost of the extensions. A

great many companies have made a survey of their distribution system with a view toward soliciting business in the localities where transformers are heavy enough to carry the load without increase.

Texas appears to be pretty heavily stocked, and the manufacturers sales in that territory will not be up to the usual high mark. The Middle West has been good. Some large properties put in a rate about two months ago and started a campaign which they were unfortunately forced to abandon because of their inability to secure ranges. The rest of the Middle Western territory from Minnesota through to Oklahoma will show about normal business as compared to pre-war conditions.

The South from Virginia to Florida and across to Louisiana will show above normal this year inasmuch as a good many of the central stations purchased pretty heavily this spring. This appears to be coming territory.

In the territory west of the Mississippi River as far as the east slope business should be fair, but things have been pretty seriously handicapped by a drought which means that yield per acre will be away below average on both corn and wheat. This, of course, slows up business and has had a tendency to decrease the range business to a large degree.

There should be a substantial business in Colorado next year because of rates.

As far as conditions on the Pacific Coast go, they are always good and this year is no exception. Crops are good and money is plentiful. The range turnover should be above normal.

There is reason to believe that in the five or six centers on the Coast and in the Far West the central stations will finish the year without a range in stock, and some of them were loaded pretty heavily. There seems to be more intention to throw the business to the dealer in this territory rather than to handle it through the jobbers, and possibly this may have a tendency to slow up sales for a while.

The production of ranges has been away above anything that the manufacturer has yet attempted, and even with this excess production there are indications that the central stations all over the country will be fortunate if they can obtain from any or all manufacturers all of the ranges that they can sell this year. Shipments have been prompt, and while the orders placed the early part of the year were not heavy there has been a marked increase in business since March and shipments and service have been generally up to standard.

With regard to the effect of the increased price on the range business, I feel that, while it may have a tendency to slow up sales to some extent, in the long run we will not feel the effects of this increase in reduced shipments. The increase of 25 per cent is the second increase in a period of two years and it was necessary. Practically all other lines have gone up at least 50 per cent, sometimes more. Our own stove lines—that is, gas and coal—were no exception, and while in some cases there has been a 5 per cent decrease, that does not mean much. Some manufacturers of electric ranges are rather pessimistic over the outlook of increased prices, but I cannot see anything in the future to indicate that this was a step in the wrong direction or would indicate a slowing up of sales with the retailers or wholesalers.

"PRICE AT DELIVERY" POLICY IS QUESTIONED

No Unanimity of Opinion as to What Manufacturers Should Follow, Although Conditions Justify Withdrawal of Price Schedules

The practice started during the war of billing goods at the price in effect at the time of their delivery is growing among electrical manufacturers, who must buy raw material on this basis. However, the basis for the trend toward this new "price at delivery policy" is labor, because the increased cost of raw materials, such as iron, copper and coal, which are required by different manufacturers, is mainly an increase in the cost of labor. The manufacturer is also confronted with increased fabricating costs and a decreased output of labor.

A number of central-station and industrial buyers do not object seriously to this policy provided it is kept in effect for a complete cycle of rising and falling prices. Broad-gaged business men do not ask manufacturers to protect them against an increase in price and also to give them the benefit of any reduction which may become operative between the time of ordering and of delivering. But this has been and still is the policy of a number of representative manufacturers.

Some manufacturers agree with the majority of jobbers and contractor-dealers that the "price at delivery" policy is unfair and unwarranted. The jobbers feel that they can protect themselves by placing orders well ahead of their requirements. The contractors, however, will apparently be unable to get any protection when they bid on jobs.

Many buyers feel that a manufacturer should take whatever steps he may deem necessary to protect himself when he receives an order. This can and is being done by some manufacturers, but it is not always practicable. The ratio of the cost of labor to that of material in an article may be so high that labor is the governing factor in making the price, and in this case the manufacturer is unable to protect himself against the growing inefficiency and rising wages.

It is easy for a manufacturer to change his price policy if he does so without considering the results. The customers who get their goods on consignment are not likely to complain, but those who own their stock usually want to have something to say about the price paid for it. A manufacturer may have the best possible intentions but will probably have some difficulty in explaining to an irate customer why his goods were shipped just late enough to come under an increased price schedule or just early enough to miss a reduction in price. There is some question therefore whether a change to a "price at delivery" policy would not cause the manufacturers to lose more in customers' good will than would be justified by the more scientifically correct price arrangement.

FIXTURE BUSINESS REFLECTS ARRIVAL OF PEACE TIMES

Restrictions on Output and Accumulation of Stocks Have Given Way to Demand for Standard and Special Designs

From a condition of overstocks in many establishments and little movement of material, because of the exigencies of war, the fixture market has passed within the last few months to a stage wherein shortages of even standard designs are reported and where an increasing demand is bringing all the resources of this branch of the electrical art into productive effort. Industrial fixtures of relatively simple types were required during the war along with reflectors capable of being turned out *en masse;* but military and naval requirements offered small scope to the manufacturer and distributer of the fixtures pertaining to civil life. In consequence, the entry of the United States into the war found many distributers and dealers loaded down with unsalable products and the substantial overhead expense thus incurred led in some cases to the withdrawal of firms from this class of business. Some of the manufacturers were able to do extremely valuable war work in their plants, while others "put on the soft pedal" and awaited the coming of the peace period without attempting to handle much beyond routine output.

New life has entered the fixture trade with the coming of peace. Improvements and new construction in residences, commercial buildings and industrial establishments have increased month by month until it has become difficult to fill orders from some of the smaller houses. The larger houses, which were able to carry over their war-time stocks, are in a much better position to meet delivery requirements, taking them as a whole. Fortunately the very low depreciation of stocks in quality during the war works toward quick recovery of salable merchandise.

The increased demand of the last few months has put heavy pressure upon the factories, and the rise in raw-material prices and uncertainties of the labor market have been the two chief obstacles to a restoration of former production volume and deliveries. Brass, silver, gold, acids, art glass and other supplies have advanced, and at times shortages have been encountered which have made it most difficult to accumulate factory stocks or even to meet current requirements of the market. Prices have reflected these advances in cost and are probably 15 per cent higher now than in the spring. Raw materials are more plentiful, however; labor appears to have about reached the maximum wage rate plane in sight of close observers of economic conditions; standard products are in great demand, and an increasing market is showing itself for the more distinctive designs and developments, both in fixtures and portable lamps.

METAL MARKET SITUATION

Copper Prices Are Practically Unchanged in a Market Which Is Quiet but Strong

The copper market shows little activity, but its tone is good despite any labor clouds which may be apparent, and despite the presence in the market of resale copper in sufficient quantities to take care of the call noted in the trade at the present time. This resale metal is priced at 22.25 to 22.37½ cents for September, 22.50 cents for October and 22.75 to 23 cents for November and December. Producers quote September unchanged at 23.50 cents and October at 24 cents and do not see sufficient business at the present time to entice them into a lower market. They feel a returning market in the near future when the big consumers will be back with good-sized orders. It is possible that this renewed buying will cause an advance in prices, but the producers, it is learned, do not favor this.

The export outlet for copper is a waiting one. The low foreign exchange rates are not conducive to any extensive buying, and the unsettled conditions of the credit arrangements with Germany are also a deterrent in a large potential market. The consummation of peace, however, is expected to offer relief in this direction. The English market seems to lean toward wire-bar copper to a great extent. Remelting of copper into wire bars to satisfy the demands of wire drawers is reported as necessary to fill depleted stocks.

The steel workers have called a strike for Sept. 22 against the United States Steel Corporation, and they say that the strike can be prevented only by a backdown on the part of that corporation. If this strike occurs, it is probable that it will also spread to the other steel producers and gradually cause a general suspension of work on the part of all who handle steel.

The zinc market is quiet and spasmodic, most of the buying being for present delivery. The price is little below last week and is given as 7.70 cents.

NEW YORK METAL MARKET PRICES

	Sept. 2	Sept. 9
Copper:	£ s d	£ s d
London, standard spot	101 2 6	100 10 0
	Cents per Pound	Cents per Pound
Prime Lake	23.12½	23.00
Electrolytic	22.37½	22.25 to 22.37½
Casting	22.00	21.62½
Wire base	26.00	26.00
Lead, trust price	6.00	6.00
Antimony	8.62½	8.62½
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10.50	10.50
Spelter, spot	7.85	7.70
Tin	55.75 to 56.00	56.25 to 56.50
Aluminum, 98 to 99 per cent	32.00 to 33.00	32.00 to 33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	18.50 to 19.00	19.00 to 19.50
Brass, heavy	10.50 to 11.00	10.75 to 11.25
Brass, light	9.00 to 9.25	9.00 to 9.25
Lead, heavy	5.00 to 5.10	5.00 to 5.10
Zinc, old scrap	4.75 to 5.00	4.75 to 5.00

THE WEEK
IN TRADE

SEPTEMBER has started off with a rush in the electrical line. Local stocks of all wiring materials are beginning to feel the strain. Deliveries are lengthening, but manufacturers may be counted on to better this somewhat, provided that labor remains quiet for a few weeks.

The fall demand for lamps and lighting equipment has opened well. There is also greater interest being taken in pole-line material for fall maintenance against the winter.

Prices are somewhat steady, but higher prices are predicted in a number of lines, including wire, loom, fixtures and heating appliances.

Labor conditions do not seem to be so bad as they were last month, although certain sections with building trade strikes are tying up business.

Motor sales are in good shape. House meters are moving well, especially in the East, and the same is true of distribution transformers. Small sizes of rubber-covered wire, weatherproof wire and flexible armored conductor are very hard to procure. This situation is reflected in local prices.

The sales of waterwheels in small units is picking up in the South. New England reports active demand from textile mills.

NEW YORK

The supply business shows considerable strength and an encouraging condition for the summer season. Official jobbers' prices remain firm but have little bearing on the market when the trade goes shopping. Cutting in one quarter breeds cutting in another. Prices show considerable variation, and low prices have been explained in some cases by early purchases at much below present costs.

The call continues strong on the smaller sizes of rigid conduit and rubber-covered wire, and stocks of the latter are in many cases low. Large sizes of conduit and fittings are moving but not in large quantities. Flexible armored conductor is required in very large quantities for the amount of reconstruction, rebuilding and rewiring work under way. Stamped-steel wall boxes and cabinets are in heavy demand, and deliveries have been reported slow.

Building in the district of New York State and northern New Jersey for August showed contracts let 2½ per cent over July, with the August total more than 100 per cent greater than the average August figure since 1914, with previous figures in 1919 values. Ground is about to be broken in the Bronx for 658 homes under one corporation.

MOTORS.—Good orders have come in for 100-hp. and 200-hp. sizes. Deliveries range from ten to fourteen weeks. Prices are firm but tend upward. This is especially true for electric vehicle motors where the percentage of copper weight to motor weight is high.

METERS.—Demand for house meters has jumped considerably. Orders are being fed out piecemeal, in order to keep a percentage flowing to each buyer. Extremely large production is expected in a few weeks to try to build up a stock.

POWER CABLE.—Good orders are reported, with deliveries lengthening to eight weeks. No base can be quoted on account of different specifications required.

TRANSFORMERS.—Distribution sizes are moving fast under heavy demand. Factories are urging warehouses to keep their stocks up by frequent ordering on account of lengthening shipments. New York stocks are fair. Shipments on apparatus sizes have lengthened to four and four and a half months.

FRICTION TAPE.—The demand is good and prices are quoted at 37 to 43 cents a pound. One manufacturer, it is reported, expects to advance 3 cents on Oct. 1.

FLEXIBLE ARMORED CONDUCTOR.—Heavy demand is keeping stocks low and shipments tardy. No. 14 single strip holds from $78 to $85.

STEEL BOXES.—The slow deliveries reported by jobbers have been characterized by one producer as caused by small manufacturers taking orders above their capacity at a low price, with their inability to fill them. Larger manufacturers are filling without difficulty. Prices, producers state, are going to advance this fall.

NON-METALLIC FLEXIBLE CONDUIT.—Six cents a foot list is quoted on ⅜-in. Demand outside the cities is rather large. Prices are firm and tend upward.

CHICAGO

Business continues brisk in all lines for jobbers and dealers. All jobbers report an increase in business for the month of August over the same month of last year, the average being about 15 per cent. In the city of Chicago the carpenters' strike still continues to hold construction practically at a standstill. During the week not one permit was taken out amounting to more than $100,000, and only two amounted to over $50,000. The large volume of business is going to Detroit, Cleveland and other neighboring cities and towns, where the building boom seems to be general. Jobbers' sales were mostly of small plant and home lighting materials. In St. Louis plans for a million-dollar hotel have been started. The St. Louis Basket & Box Company has started work on an extension to cost $350,000.

WIRE.—There is a scarcity of weatherproof wire. Jobbers' prices vary from 28 cents to 30 cents. The base price here for rubber-covered is 30 cents and for bare 27 cents to 28 cents.

LAMPS.—The present demand is high, one jobber reporting that his deliveries have doubled those of last year.

SCHEDULE MATERIAL.—Demand has been quite heavy and the factories are still slow in making shipments.

HOME-LIGHTING FIXTURES.—One jobber reports an increase in cost of 20 per cent on home-lighting fixtures due to higher brass prices. Deliveries are fair, although on brass they take about thirty days.

INDUSTRIAL LIGHTING FIXTURES.—There is a big demand. An increase of about 20 per cent in price has been put into effect by one manufacturer.

FARM-LIGHTING SETS.—Business is the best in the history of most makers. Although foundry strikes have been responsible for a shortage of raw materials, stocks are in pretty good condition and deliveries can be made almost immediately.

POLES.—There is a fair demand for poles of smaller dimensions. A 7-in. by 30-ft. cedar pole costs f.o.b. Chicago $9.05.

INDUSTRIAL CONTROL APPARATUS.—Deliveries are from thirty to sixty days behind orders on account of the slowness in obtaining raw materials.

FLASHLIGHT BATTERIES.—Prices are steady on a fair market. A large demand is anticipated for the holiday trade. A three-cell battery lists at 60 cents with 40 per cent for barrel lots.

RANGES.—Some dealers are reporting a falling off in sales on account of the recent increases in price, but others are so far behind on their orders that they have felt no change in the demand. The Hughes-50 range is listed at $156.

IRONS.—Sales are rapid, and it is difficult to keep stock on hand. A 6-lb. iron ranges in price from $6.50 to $7.50.

WASHING MACHINES.—Both dealers and jobbers report the best business in their history. An average price for the cylinder type is $125.

LAMP SOCKETS.—Dealers and jobbers report that the stocks of pull-chain sockes are all gone from this section. Other line stocks are only fair.

ELECTRIC ELEVATORS. — Manufacturers have been working day and night trying to catch up with orders on which they are from one month to six months behind.

BOSTON

The week opened with trade extremely active, prices holding firm in most lines, stocks considerably depleted and deliveries tending longer. Threats of a general strike at Boston fill the air at this writing. Collections are holding up well. Wiring material shortages reflect the present heavy demand for building construction. Rumors of further price increases in electric heating apparatus are being circulated in the trade. Contractors are very busy. Retail sales are excellent.

WIRE.—Prices remain at the 30-cent base for rubber-covered and weatherproof, bare being steady at 27 cents base. Stocks are being depleted in the smaller sizes, though the market's needs have been pretty well cared for so far. Quotations ranging from $48 to $72 were noted this week on solid No. 6 double-braided rubber-covered wire, according to quantity.

SOCKETS.—Key sockets were quoted at 24.75 cents Monday in standard packages, keyless at 22.5 cents and pulls at 45 cents each. Deliveries show little tendency to improve.

PORCELAIN FITTINGS. — Distributers report these harder to get. The hoped-for weakening in prices does not materialize.

CONDUIT.—Quotations Monday out of jobbers' stock were $70.30 per 1000 ft. for ½-in. galvanized and $65.03 for black. One-half-inch fittings were selling at $0.0578 and 3-in. fittings at $0.525. Elbows range from $0.1568 for ½-in. to $4.20 for 3-in., jobbers' prices.

MOTORS.—Trade is exceedingly brisk in textile motors. Stocks are low at the factories, but deliveries are being well maintained, with steady prices. Motors for general service are in good demand. Single-phase motors are reported short in supply.

ARMORED FLEXIBLE CONDUCTOR.—All New England seems short. Quotations run as high as $90 per 1000 ft. for No. 14 single-strip, owing to the scarcity. Nominally prices are nearer $75, but the present market is too unstable for accurate figuring.

NON-METALLIC FLEXIBLE CONDUIT.—The supply is spotty and the demand active. Prices are fairly steady. A quotation of $23 per 1000 net ⅜-in. was current Monday, ½-in. loom bringing $25, net.

FIRELESS COOKERS.—The demand is reported by a leading jobber to be rapidly increasing. A representative make brought $30.25 in the single-compartment size and $51.25 in the two-compartment, this week.

RANGES.—Recent price advances continue to disturb the market. The outlook is very uncertain as to retail trade. Sales at the new prices do not materialize to any great extent yet.

PERCOLATORS.—Prices may go higher about Sept. 15, according to reports. A list of $12.75 is quoted on a leading make. A fair demand is noted.

LAMP CORD.—Cotton-covered cord is plentiful, ranging from $21 to $26 per 1000 ft. in price.

DRY BATTERIES.—Prices and demand are steady, with good stocks. The No. 6 size sells for 40 cents retail in most places.

WASHERS.—Deliveries in some makes are a little better, jobbers state.

METERS.—The demand is steady, without price fluctuations. So far deliveries have been about equal to market requirements.

ATLANTA

The past week in this section was marked by steady increase in the sale of a majority of all staple electrical lines. There seems to be a prevalent tendency on the part of a good many dealers to place slightly larger orders because of apprehension regarding deliveries. For the past six weeks now the promises of shipment from Eastern points have been steadily growing longer, and jobbers and dealers do not care to be caught with meager stocks in the face of a growing demand and no way in sight to fill it.

The labor situation is comparatively better this week in all classes of industry and production has increased materially. The utilities strike in the Carolinas has quieted down. Collections reported from all channels are in excellent condition.

WATERWHEELS.—Manufacturers' representatives report business picking up, especially for small private power plants. Shipments promised are reasonable.

ATTACHMENT PLUGS.—The demand continues strong with no apparent likelihood of abatement for some time. Deliveries are very good and keeping up with requirements. Two-piece plugs are quoted at 24 cents, net, in standard packages.

LAMP GUARDS.—Of late trade has been somewhat dull, but indications this week point to an early opening of the fall demand. Prices remain steady, shipments are good and stocks are ample. In lots up to fifty jobbers quote $36.30 per 100; in lots of 50 to 100, $33, and in lots of 100 to 150, $29.70.

PORCELAIN CLEATS.—Renovating has called for large quantities. Jobbers quote unglazed two-wire and three-wire per 1000, net, in standard packages, $18.90.

SOCKETS AND RECEPTACLES.—The call is insistent and large lots are being moved. Factory shipments are very poor, but so far stocks are in fair shape. On ½-in.-cap key and push sockets jobbers quote 33 cents net, standard packages; ½-in.-cap keyless sockets, 30 cents, standard packages; ½-in.-cap pull sockets, 60 cents, standard packages.

KNOBS.—New construction has tended to accelerate the movement. Local stocks are in fair condition. Factory shipments grow longer. Jobbers' price per 1000 net is $19.80 in standard packages and over.

WIRE.—There is no let-up in buying and heavy demand has depleted stocks of weatherproof and a few sizes of rubber-covered. In a few instances incoming shipments have relieved jobbers. We quote jobbers' price on triple-braid solid-conductor, net, per 100 lb., f.o.b. Atlanta, in 500-lb. to 1000-lb. lots: 4/0 to 4, $33.45; 6, $33.95; 8, $34.45; 10, $36.45; 12, $38.55.

KNIFE SWITCHES.—Dealers report a big business. Jobbers are ordering in substantial quantities, anticipating still poorer factory shipments. On the average Southern stocks are getting quite low. Prices are firm. List price on 250-volt and 500-volt plain-finish, front-connection, no-fuse, from jobbers' stock, range from $2.39 for 30-amp. s.p.s.t. to $21.36 for 300-amp. t.p.s.t. A discount of 15 per cent on $25 to $50 list, with 2 per cent cash ten days, is quoted.

SOLDER.—Sales have shown a decided gain. Jobbers' prices for pound net are: Less than 5 lb., 75 cents; 5 lb. to 25 lb., 65 cents; 25 lb. to 50 lb., 50 cents.

CROSS-ARMS.—Jobbers continue to enjoy a big trade with sporadic deliveries. A few jobbers are in good shape and free movements are being made. Prices are steady this week. We quote jobbers' price net, each in standard 3¼-in. by 4¼-in., for 1½-in. pins, Washington fir, 1000 linear feet and over: 49 cents, two-pin, 3 ft.; 64 cents, four-pin, 4 ft.; 80 cents, four-pin, 5 ft.; 96 cents, four-pin, 6 ft.

FLASHLIGHT BULBS.—Jobbers and dealers state that business is increasing rapidly as the fall season advances. Stocks are well up to standards. Unbroken unit packages are quoted by jobbers at 15 cents each; ten or more unbroken unit packages, 12 cents.

SEATTLE—PORTLAND

Again Seattle's commercial activities are being hampered by strikes. A strike in the building trade on Sept. 2 has closed down every building job of importance in Seattle. On Sept. 6 gas company employees in Seattle struck. The demand for electric tableware increased immediately. Strikes in the logging camps in western Washington are increasing, and nearly every shingle mill in Gray's Harbor country is closed. Both electrical jobbers and dealers report that as a result of strikes and lockouts sales during the past week were very light.

The Portland district reports general business conditions unchanged. Garage and small factory building construction continues to increase. Residence construction is having a slight check, and this is undoubtedly going to be still more marked in the near future because of demands of labor. The Oregon Brass Works, Portland, will immediately install what is claimed to be the first electric brass furnace on the Coast. In Portland most stocks are in fair condition, but meter stocks are very short; in fact, local jobbing houses are entirely out of 5-amp. sizes and have a large number of stock orders on hand. Wire stocks are also getting short. Promise of delivery at the present time on No. 8 code and the smaller sizes is not less than four months.

FARM-LIGHTING PLANTS.—Increasing sales during the past two weeks have been noted, particularly in eastern Washington and Oregon. Stocks of these appliances are in good shape.

LAMPS.—Standard sizes show increasing sales. The demand for 100-watt, 200-watt and larger sizes is on the upward trend. Stocks are well filled at present and shipments from the East and California factories are coming through in good shape.

SAN FRANCISCO

Practically all departments of the electrical business show great activity. Money is plentiful and dealers' campaigns for house-wiring and device sales are reported very effective. It is fortunate that the greater portion of the state crops has been marketed because weather conditions, so promising during the spring and early summer, have slumped and unexpected rain has done some damage to grapes. There is less snow on certain mountain districts than has been reported for many years. Crop prices are remarkably high, raisins and prunes being fully 100 per cent over 1918 figures.

BOXES AND COVERS.—The demand is steady, although not extraordinary. Stocks are good. A slight price advance of 5 per cent has occurred.

HOUSE GOODS.—This line, which includes annunciators, push-buttons and other fancy electrical hardware, is comparatively slow, but there have been many inquiries for large annunciators for the use of hotels and apartment houses.

FIRE-ALARM MATERIAL.—Inquiries have practically disappeared, but one or two large jobs, such as that for Daly City, requiring more elaborate non-interfering boxes, are on file.

WATER HEATERS.—Inquiries for heaters for industrial use are growing. Mines, for instance, are considering the use of heaters to keep certain water operations above freezing during the winter. This business is largely pioneer work.

STANDARD PORCELAIN.—Demand is rather quiet. Stocks are good.

RAILWAY EQUIPMENT.—Stocks are fair, with practically no demand, save for a few extra field coils. Almost no railway motors are being shipped.

IRONING MACHINES.—Poor factory deliveries have hampered some excellent missionary work which a price advance has failed to interrupt. New methods and assistance given dealers in handling time-payment accounts will enable them to exploit the joint sale of a washer and an ironing machine, using but one motor for both.

LAMPS.—Lamp sales are holding up well and deliveries are good, save for the new white lamp. Advance advertising was held until it was thought that sufficient stocks of this style of lamps had been accumulated, but the result has far surpassed expectations, and there has been a dearth of this type for the past month.

BELL-RINGING TRANSFORMERS.—Dealers report that their sales of batteries for bell-ringing purposes have dropped down to a very low figure, and that the public generally is educated to the value of bell-ringing transformers for the purpose. This transformer is now a staple and universally stocked.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

Armored Conductor, Flexible Steel

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%

Twin-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft.	5%
	No. 12 Solid
Less than coil	Lis
Coil to 1000 ft.	5%

Twin-Conductor

	No. 14 Solid
Less than coil	$90.00 to $104.00
Coil to 1000 ft.	85.00 to 95.00
	No. 12 Solid
Less than coil	List
Coil to 1000 ft.	5%

Attachment Plugs

List ranges from $0.22 to $0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to list
1/5 to std. pkg	List to 20%
Std. pkg	23% to 36%

Batteries, Dry

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.40	.40
50 to barrel	.36	.37
Barrel lots	.329	.339

Batteries, Dry—*Continued*

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.362	.372
Barrel lots	.332	.342

Conduit, Metallic Flexible

Size, In.	Ft. per Coil	List per 100 Ft.
3/8	250	$5.00
1/2	250	7.50
3/4	100	10.00
1	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
1/2-in. single trip	$75.00	$63.75— 69.75
1/2-in. double strip	75.00— 82.50	72.00— 75.00
1/2-in. single strip	100.00	85.00— 93.00
1/2-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
1/2-in. single strip	$75.00	$63.25 to $63.75
1/2-in. double strip	78.25	71.25
1/2-in. single strip	100.00	75.00 to 85.00
1/2-in. double strip	105.00 to 109.00	93.00 to 95.00

Conduit, Non-Metallic Flexible

Size, In.	List per Foot	Size, In.	List per Foot
3/8	$0.05 1/2	1	$0.25
1/2	.06	1 1/4	.33
3/4	.09	1 1/2	.40
3/4	.12	1 1/2	.47
3/4	.15	2	.55
1	.18	2 1/2	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
3/8-in.—	$35.00	$27.50	$26.50
1/2-in.—	35.00	30.00	29.00

NET PER 1000 FT.—CHICAGO

	Less than 250 ft.	250 to 2500 ft.	2500 to 10,000 ft.
3/8-in.-	$48.00	$27.75	$26.00
1/2-in.—	$52.00	30.50	28.25

Conduit, Couplings and Elbows, Rigid Iron

Card No. 42

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	08 1/2
1/2	08 1/2
3/4	11 1/2
1	17
1 1/4	23
1 1/2	27 1/2
2	37 1/2
2 1/2	58 1/2
3	76 1/2

Conduit, Couplings and Elbows, Rigid Iron—*Continued*

Size, In.	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/4 in.	3/8 in. to 3 in.
Less than 2500 lb.	1% to 12.1%	3% to 14.1%
2500 to 5000 lb.	6% to 15.1%	8% to 17.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 to 1/2 In.	3/4 to 3 In.
Less than 2500 lb.	+3% to 3.1%	2% to 2.1%
2500 to 5000 lb.	+1% to 5.1%	4% to 7.1%

(For galvanized deduct six points from above discounts.)

Flatirons

NEW YORK

List price	$6.25 to $7.50
Discount	25%

CHICAGO

List price	$6.75 to $7.50
Discount	25% to 30%

Fuses, Inclosed

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	40%

Fuse Plugs

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$6.00 to $8.75
1/5 to std. pkg.	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$8.00
1/5 to std. pkg.	7.00

Standard packages, 500. List each, $0.07

Lamps, Mazda or Tungsten

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg.	10%

Lamp Cord

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$28.60–$35.01
Coil to 1000 ft.	25.74– 29.17

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$23.50–$32.00
Coil to 1000 ft.	23.50

Lamp Guards, Wire

Standard packages from 50 to 150

NEW YORK

Net per 100	$29.70 to $33.00

CHICAGO

Net per 100	$29.70 to $33.00

Outlet Boxes

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%–38%	20%–33%
$10.00 to $50.00 list	36%–47%	31%–43%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	33%	24%–25%
$10.00 to $50.00 list	45%	32%–37%

Pipe Fittings

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

Porcelain Cleats—Unglazed

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$17.85 to $22.40
1/5 to std. pkg.	14.70 to 15.35

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$18.00 to $18.90
1/5 to std. pkg.	15.00 to 15.75

Standard pkg., 2200. List per 1000, $20.00 to 21.00

Porcelain Knobs

NEW YORK

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid	Nail-it—N.C.
Less than 1/5 std. pkg	$13.60–$15.00	$22.00–$22.40
1/5 to std. pkg.	10.50– 11.20	15.35– 16.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid	Nail-it—N.C.
Less than 1/5 std. pkg.	$14.40	$28.00
1/5 to std. pkg.	12.00	23.00

Sockets and Receptacles

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20 to list
1/5 std. pkg.	List to 10%

Switches, Knife

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-qmp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	$0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%
$10 to $25 list	+10%
$25 to $50 list	+5%
	Low Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%

Switches, Snap and Flush

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

Switches, Snap and Flush—*Continued*

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List
Std. pkg.	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List
Std. pkg.	23%

Switch Boxes, Sectional Conduit

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	18%–20%	List–18%
$2.00 to $10.00 list	28%–30%	5%–28%
$13.00 to $50.00 list	45%–50%	10%–47%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	15% to 25%	25% to 30%
$2.00 to $10.00 list	15% to 25%	25% to 30%
$10.00 to $50.00 list	25%	25% to 30%

Toasters, Upright

NEW YORK

List price	$6.25 to $7.00
Discount	25%

CHICAGO

List price	$7.50
Discount	25% to 30%

Wire, Annunciator

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.52
No. 18, full spools	.51

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.54 to $0.57
No. 18, full spools	.48 to .51

Wire, Rubber-Covered, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$16.00	$13.00	$13.00
12	21.78	21.78	18.15
10	31.18	27.67	22.64
8	42.12	38.77	31.64
6	61.16	55.60	50.04

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$25.00	$14.00	$12.50–14.00
12	30.00	19.00	19.00
10	35.77	35.77	30.66
8	42.84	42.84	36.72
6	67.80	67.80	56.50

Wire, Weatherproof

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$34.00
25 to 50 lb.	34.00
50 to 100 lb.	33.00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$33.00
25 to 50 lb.	33.00
50 to 100 lb.	33.00

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Flexible Industrial Fixture

Simplicity, flexibility and durability, besides having light accessible to any place, are claimed as the outstanding features of the Sampson-Access system

FIXTURE CAN BE TURNED IN ANY DIRECTION

of industrial lighting manufactured by the Access Electric Manufacturing Company, Lynn, Mass.

The system embodies the use of flexible arms consisting of a 30-in. top piece of ¾-in. conduit, a bell-and-socket A. B. box clamped, or a ¾-in. by 3¼-in. (18-mm. by 81-mm.) slot in the conduit, in which is secured by ball joint ½-in. (13-mm.) conduit of any desired length. On the end of this is a 7-ft. (2.7 mm.) arm of flexible metallic conduit. A shade, socket and lamp complete the fixture.

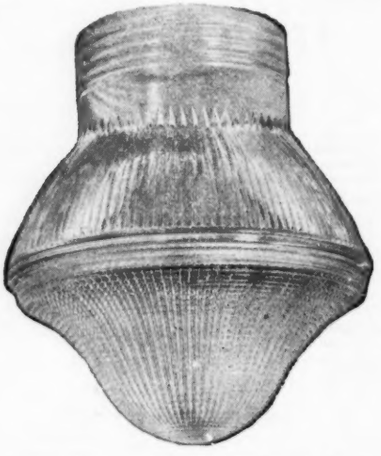
The producer points out that the fixture will turn in any direction, support a heavy socket and shade, is not affected by oil, dirt or vibration, nor has it any projections to be in the way or to injure the workman. Furthermore, the fixture is one not easily injured by the workman.

Vapor-Proof Reflector Globe

In the past, the Holophane Glass Company of 340 Madison Avenue, New York City, points out, vapor-proof lighting fittings have been equipped with clear-glass globes, and in order to obtain an efficient lighting unit it has been necessary to place a reflector over the glass globe. To make such practice unnecessary this company has designed a combined vapor-proof globe and reflector by using a prismatic construction.

The reflecting prisms are on the upper portion of the globe to redirect the light in downward directions, while the refracting and diffusing prisms are on the lower surface to distribute the light in different directions in the desired proportions so that the resulting illumination on the work will be uniform. Tests show, the maker declares, that the new vapor-proof reflector globe gives illumination 75 per cent over that given by an ordinary clear vapor-proof globe.

These vapor-proof reflector globes are made for the 40-watt and 60-watt



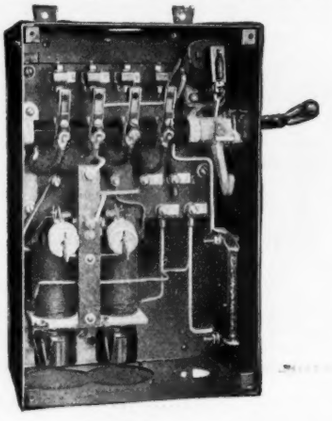
NO REFLECTOR IS NEEDED WITH THIS GLOBE

type B lamps and for the 75, 100, and 150-watt type C lamps. They may be used in connection with the standard vapor-proof fittings now on the market, including those having the standard navy thread.

Two Starters for Squirrel-Cage Motors

Inverse-time-limit overload protection and the limiting of the starting current by providing resistance in each of the three phases are the main new features incorporated in two new types of polyphase squirrel-cage motor starters manufactured by the Cutler-Hammer Manufacturing Company, Milwaukee.

The "Bulletin 9117" starter has, besides a low-voltage release, a duplex time-limit overload relay which is a complete unit in itself. The design of this overload movement is such that it does not open the circuit of the low-



BULLETIN 9117 STARTER WITH FRONT COVER REMOVED

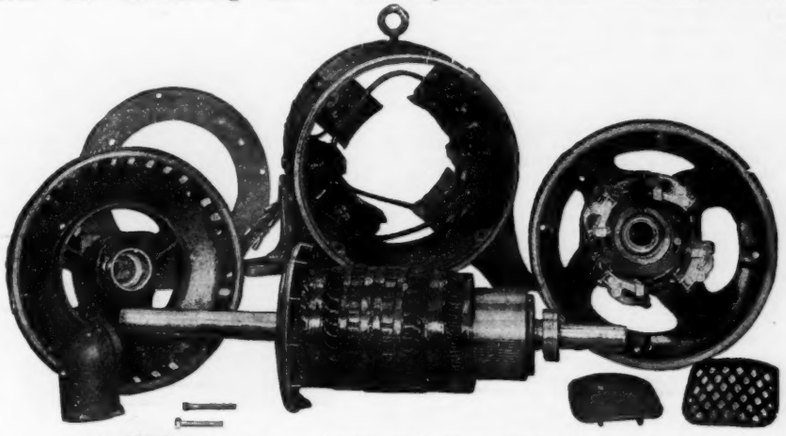
voltage coil on a high initial inrush of current nor on a momentary overload, but it will not permit a harmful overload to be maintained. This condition is obtained by retarding two moving plungers in oil dash pots. The plungers, which are actuated by two operating coils, trip a single contact-making device, thus opening the motor circuit. At the same time the force of each

LOWERING PANEL OF BULLETIN 9118 STARTER DEADENS FUSES

plunger must overcome an adjustable weight which may be set at various positions along a lever arm, depending upon the amount of current desired to operate the plunger. By turning an adjusting screw the flow of oil around the plunger head may be regulated,

thereby changing the time required for the relay to operate.

To start the motor the operator moves the starter handle to the "up" position. This connects the motor to the line and brings into position an interlock which prevents opening the cover of the case. To stop, the operator simply moves the lever back to the stop position, which opens the circuit with a quick break and removes the interlocking bar. The starter is made with either three or four poles for use with standard squirrel-cage motors from 3 hp. to 15 hp. and with nigh-torque motors of the "internal-starter" type from 7½ hp. to 25 hp. where the line voltage does not exceed 550 volts.



UNASSEMBLED PARTS OF COMMUTING-POLE, DIRECT-CURRENT MOTOR

The starter known as "Bulletin 9118" is essentially a modification of the inclosed polyphase-motor starter, "Bulletin 9116," a description of which has already appeared in these pages. This starter has been designed for those motors which cannot be connected directly to the line without resulting in a dangerously large starting current. One step of resistance is provided in each of three phases during starting, allowing the motor 60 per cent line voltage and an inrush of approximately three times full-load current. By using another set of terminals the resistor is decreased to give approximately 75 per cent line voltage and three and one-half to four times normal current. The low-voltage protection coil automatically returns the switch to the "off" position upon failure of voltage.

The motor is started by raising the handle to the starting position, which closes the switch. When full speed is reached the handle is released, causing the switch contacts to slide into the running contacts, without opening the motor circuits when the fuses are thrown in the motor circuit.

This starter is for starting standard polyphase squirrel-cage motors of from 1 hp. to 10 hp. on any commercial voltage not exceeding 550 volts. The starter can be furnished with resistors suitable for two-phase, four-wire circuits, in which case an additional knife switch is required to disconnect the motor entirely. Both types of starters are completely inclosed.

Commutating-Pole Direct-Current Motors and Generators

The type "E" line of commutating-pole direct-current motors and generators which has just been introduced by the Allis-Chalmers Manufacturing Company of Milwaukee, Wis., includes the following standard ratings: Continuous-rated (50 deg. C. rise) motors, for applications where the power requirements are definitely known; normal-rated (40 deg. C. rise) general-purpose motors; adjustable-speed motors for continuous or intermittent service, and generators and exciters. For constant-speed motors the ratings and speeds are the same as those of 60-cycle induction motors, and they can thus be used interchangeably with induction motors for direct-connected applications without changing the method of drive or the ratio of gearing. Adjustable-speed motors, intended particularly for machine tools and similar applications, are provided for two to one, three to one or four to one speed range. Generator speeds also correspond to those of induction motors, thus permitting the direct coupling of the machines to form motor-generator sets in various combinations. The line of ratings now complete covers motors from ½ hp. to 50 hp. and generators from ½ kw. to 40 kw., while larger sizes are under development. The motors are designed for belted as well as direct-connected applications.

Cast-steel yokes, combining light weight and rigid construction, are used for the larger ratings, while the smaller machines, which are of the bipolar type, have riveted frames. The accessibility of the commutator is a feature of the new line. Protecting grid covers can be provided for these openings in the front bearing bracket; they are readily attached and may be applied even to machines in service, the maker states, without affecting the rating. Solid covers are used with completely inclosed motors, the rating of these machines being somewhat lower than that of open or semi-inclosed motors.

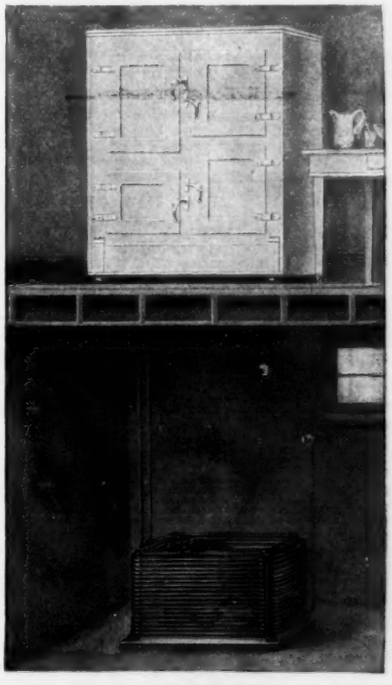
All machines have ring-oiling, dust-proof bearings, while the windings are treated to resist oil and moisture. Conduit terminal boxes, regularly supplied, have removable covers, giving ready access to the terminals. Box-type brush holders are adjustable for tension and suitable for either direction of rotation. Each holder can be removed independently with a screwdriver or wrench. At least two brushes per stud are used. The field coils are wound on metal spools, which prevent any movement of the coils, and are protected by an outside layer of enameled wire. The armature core has laminations riveted together, permitting the removal of the shaft without dismantling the core of commutator, while for ratings of 20 hp., 850 r.p.m., and larger the core and commutator are built on a sleeve, so that the shaft can be pressed out of the finished armature without disturbing the windings.

An important feature of the machines is held to be the very thorough ventilating system which has been provided.

Electrical Refrigerator

An electrically operated refrigerating unit that fits into the ice compartment of any standard refrigerator is now being marketed, largely through central stations, by the Kelvinator Corporation, Detroit, Mich. The cooling tank fits into the ice chamber, while the motor compressor and condenser are placed downstairs in a corner of the basement.

Sulphur dioxide is used as an evaporating agent. The design allows for the freezing of small cakes of ice for table use. The machine is supplied in three standard sizes. A ¼-hp. motor is used. The running time is stated by the manufacturers to be from six to eight hours daily.



NO UNSIGHTLY MACHINERY IN KITCHEN

Manufacturers' Activities

THE MASCO COMPANY, LTD., Toronto, has been appointed distributer for the "Uni-Lectric" lighting outfit in Ontario.

THE H. W. JOHNS-MANVILLE COMPANY, New York City, has commenced excavating for a big plant at Waukegan, Ill.

THE HEMINGRAY GLASS COMPANY, insulator manufacturer, has moved its general office from Covington, Ky., to Muncie, Ind., where the factory is located.

THE BRYANT ELECTRIC COMPANY, Bridgeport, Conn., manufacturer of electric switches and other electrical products, has awarded a contract for a four-story addition, 60 ft. by 220 ft., on Hancock Street.

GENERAL ELECTRIC COMPANY, Fort Wayne, Ind., plans to increase its working force by approximately 1000 employees. During recent months business has constantly increased until now the company is deeply feeling the need of more men.

THE WARD LEONARD ELECTRIC COMPANY, Mount Vernon, N. Y., has removed the office of its Philadelphia representative, William M. Tompkins, from the Comonwealth Building to the Bourse Building Machinery Exhibit, Philadelphia.

VOSS MANUFACTURING COMPANY, Davenport, Iowa, will build a three-story addition, 50 ft. by 150 ft., to its plant. It will be connected to the main factory by an overhead L and a tunnel. The company has booked one order alone for ten carloads of washing machines from a Pittsburgh concern.

SAMUEL F. JOOR, consulting engineer of Chicago, has joined the American Steam Conveyor Corporation of that city in the capacity of sales engineer. Mr. Joor has had wide experience in the conveyor field, at one time being Western manager and sales enigneer of the Jeffery Manufacturing Company, and previous to that being with the Link Connected Belt Company.

THE VICKERS-WESTINGHOUSE COMBINATION.—The shareholders of the British Westinghouse Electric & Manufacturing Company, Ltd., have received a circular regarding the proposed alteration of the title of the company. Operative this coming October, the name of the company will be changed to Vickers Electrical Company, Ltd. The contemplated change of name was under consideration at the time the control of the company was transferred from America to England.

CHANGES IN PERSONNEL OF WESTINGHOUSE LAMP COMPANY.—Effective July 1, W. T. Blackwell was appointed assistant commercial engineer for the Westinghouse Lamp Company and W. A. McKay was appointed assistant to commercial engineer of the Westinghouse Lamp Company. N. S. Braden, formerly manager of sales for the Canadian Westinghouse Company, has been elected vice-president of that company, and H. M. Bostwick, who has been assistant manager of sales for the Canadian Westinghouse Company, has been appointed manager of sales.

HOOVER MANAGERS TO MEET ONCE A MONTH.—To discuss sales and manufacturing problems the departmental managers of the Hoover Suction Sweeper Company meet once a month. General problems relating to the management of the plant are discussed, and information is given out that is of value to each individual manager. The discussions are of a general nature, and no details of any particular department are taken up. These meetings usually take the form of a dinner as this makes the discussions more intimate and makes the meetings savor less of regular routine. Production foremen's gatherings are held more frequently than others, and at these meetings specific problems are discussed and solved. All members of the firm from the president down attend the meetings, which comprise not only the factory heads but also the men in charge of the different departments of the office. This enables the office man to see the difficulties from the production man's standpoint, and it also shows the factory men something about the problems of the men in the sales, accounting, order and collection departments. A number of important changes and forward steps have been traced to these meetings.

THE ROBBINS & MYERS COMPANY, Springfield, Ohio, will establish a branch plant at Brantford, Ont.

THE NATIONAL FIBRE & INSTALLATION COMPANY, Yorklyn, Del., has awarded a contract for a two-story reinforced-concrete addition, 60 ft. by 140 ft.

THE SPENCER TURBINE COMPANY, Hartford, Conn., is the successor of the Organ Power Company, manufacturer of motor-driven steel blowers for organs, and the Spencer Turbine Cleaner Company.

F. H. BOYER, who was formerly connected with the Chicago office of the Electrical Engineers' Equipment Company, has opened an office in the Hubbell Building, Des Moines, Iowa, and will represent the same company in a selling capacity in Iowa and Nebraska.

THE NATIONAL CONDUIT COMPANY, LTD., has been incorporated at Toronto, Canada, to manufacture and deal in conduits and to carry on a general engineering and contracting business in all its branches. For these purposes the company acquires and takes over the undertaking and all or any of the assets and liabilities of the Orpen Conduit Company, Ltd. Capital is $100,000.

JOHN T. ROME, specialist in electrical insulation material, has established headquarters at Montreal. He specializes in supplying the most suitable insulation from specifications and drawings of prospective electrical work and is the Canadian representative of the Imperial Porcelain Works of Trenton, N. J. Mr. Rome represents the Wilmington Fibre Specialty Company and the General Insulate Company.

F. O. CREAGER has been made manager of motor sales for the Adams-Bagnall Electric Company, Cleveland, Ohio, with headquarters in Chicago. Mr. Creager's experience in the electrical industry covers a period of twenty years, twelve years of which have been in the commercial end of the industry. He recently resigned from the Westinghouse Electric & Manufacturing Company, where he has been connected with the sales department for ten years, specializing in the sale and application of fractional-horsepower motors.

ROY R. BURNHAM, formerly associated with the engineering firms of Hollis French & Allen Hubbard, Monks & Johnson, and Fay, Spofford & Thorndike, Boston, has opened consulting engineering offices at 15 Beacon Street in that city. He will specialize in the design and installation of electrical, heating, plumbing and elevator equipment for residences, public buildings, industrial and power plants and in the investigation and use of such equipment in existing buildings. Mr. Burnham is a native of St. John, N. B., and came to the United States at the age of eleven. After receiving a high-school education at Medford, Mass., he took the electrical engineering course of the International Correspondence Schools. His first engineering work was with the New England Telephone & Telegraph Company. Four years of inspection work and two years in the engineering department were followed by a term of service in the electrical department of French & Hubbard, where Mr. Burnham laid out the electrical system and elevator installation of the Springfield (Mass.) municipal group of buildings and was occupied with other designing problems. At the office of Monks & Johnson Mr. Burnham had charge of the electrical design and installation work of the "Victory" destroyer plant at Squantum, Mass., extensions of the Fore River Shipbuilding plant at Quincy, Mass., electric crane installations for the Watertown Arsenal, and various industrial plants, including improvements or extensions at the Colt Manufacturing Company, Hartford, Conn., buildings at Worcester, Lowell and Lawrence, Mass., for the Burgess-Lang Company, the new factory of Gray & Davis, Boston, Wright & Potter Company, Boston, and others. After six years with this firm, Mr. Burnham joined the staff of Fay, Spofford & Thorndike, Boston, as chief electrical engineer on the design and construction of the Boston army base. In less than two years electrical work representing an outlay of about $4,000,000 was planned and completed under his direction. (See ELECTRICAL WORLD, April 19, 1919.)

JOHN KELLY, who for a number of years was New York district manager of the Edison Storage Battery Company, has been appointed general sales manager of the company, with headquarters at Orange, N. J. This promotion for Mr. Kelly follows closely upon his previous promotion, on July 1 of this year, to the position of assistant general sales manager. Mr. Kelly brings to his new position the experience of a long and varied career in the storage-battery, electric vehicle and accessory business. For nine and one-half years he was district manager of the New York office of the Edison company. Before that he had been a salesman for the Westinghouse Storage Battery Company for two years, for the Swinehart Tire & Rubber Company for three years, for the Firestone Tire & Rubber Company for two years and for the New York Edison Company for nearly four years.

JOHN KELLY

THE ELECTROLYTIC OXY-HYDROGEN LABORATORIES, INC., New York City, announce the formation of a sales and manufacturing company under the name of the Electrolabs Company. This will give them an opportunity to increase their organization to met the increasing demand of their business. Electrolytic Oxy-Hydrogen Laboratories, Inc., will continue in charge of the laboratories and maintain a technical supervision over the work of the new company. The general offices and works of both companies have been moved from Dayton, Ohio, into larger quarters at 2635 Penn Avenue, Pittsburgh, Pa. The facilities for production of the new plant will be many times greater than the old plant and will make possible even better deliveries than in the past. The general sales offices are being continued at 15 William Street, New York City, and branch sales offices have been opened in the Morris Building, Philadelphia, and the Merchants' Exchange Building, San Francisco. I. H. Levin continues in charge of technical and laboratory work and D. J. Tonkonogy will continue to be in general charge of sales.

Supply Jobbers' Notes

STANLEY & PATTERSON, New York City, electrical supply jobbers, have removed their offices from their downtown store at 23 Murray Street to their warehouse at Hubert and West Streets.

E. E. HEDLER and JOHN SHERMAN announce the organization of the Hedler & Sherman Company, Widener Building, Philadelphia, for the sale of dependable electrical specialties, representing the Art Metal Manufacturing Company, Cleveland, Ohio, illuminating engineers, "Amco" brand of industrial, commercial and residential lighting fixtures; the Anylite Electric Company, Fort Wayne, Ind., "Anylite" electric dimmer; Edwards & Company, Inc., New York City, "Edwards" electrical house goods, signaling apparatus, etc.

GEORGE HULL PORTER, who has just been appointed railway sales manager of the Western Electric Company, was born in Danbury, Conn., in 1883 and received his education at the Mount Pleasant Military Academy in Ossining, N. Y. Since 1902 he has spent practically all of his time in the electrical industries, becoming a member of the Western Electric Company's organization in April 1908, as a steam-railway salesman connected with the Chicago office. Some time after he became Western manager of the railway sales department. Mr. Porter, in addition to being president of various railroad and

G. H. PORTER

electrical associations and chairman of civic societies and committees, has served on the staff of the Quartermaster General of the army and received a commission as captain. He rejoined the ranks of the Western Electric Company in December, 1918.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An American firm (No. 30,504) desires to obtain for one of its clients in Spain all classes of apparatus used by manufacturers of wireless equipment.

A firm in Australia (No. 30,461) wishes to purchase from manufacturers opalescent glass for use in indirect and semi-direct electric lighting fixtures.

The president of a Spanish mining company (No. 30,498) is in the United States and is soon to return to Spain. He desires to purchase electric motors and equipment.

The Municipal Tramways Trust of Adelaide, South Australia, will shortly ask for bids for the installation of a new 10,000-hp. electrical unit for its plant, according to Consul Starrett. It is planned to have the new equipment in operation within eighteen months. American manufacturers of electrical machinery and equipment should address inquiries to general manager Municipal Tramways Trust, Adelaide, South Australia.

Leone R. Talvy, Via Vivajo 21, Milan, Italy, a member of the American Chamber of Commerce for Italy, is desirous of getting in touch with American manufacturers who may be looking forward to extending their business to European countries. Mr. Talvy is favorably quoted in Italy and is in a position not only to cover Italy, but also Serbia, Rumania, Bulgaria and European Turkey, being acquainted with the market in those countries and having branch offices in Belgrade, Serbia. He is particularly interested in wires, cords and cables, lamp holders with and without switches, power switches and circuit breakers, automatic appliances for lighting elevators and all other appliances for lighting purposes, meters, transformers, lamps of 120 to 220 volts, equipment for telephones and bells, lighting fixtures, motors from 1 hp. to 2 hp. and storage batteries.

A firm of import merchants in India (No. 30,462) desires to connect with selling agents of American manufacturers of electrical supplies. Quotations, with samples where necessary, are requested.

An agency is desired by a firm in Spain (No. 30,475) for the sale of electric conductors, electric machinery, material for central generating stations, small electrical material, pumps, turbines, internal-combustion motors and lamps.

A merchant in France (No. 30,399) desires to secure an agency for the sale of electrical apparatus and equipment, such as bells, electric light accessories, telephone equipment and switchboards. Correspondence should be in French.

Trade Commissioner Bengtson has submitted a list of Norwegian importers of electrical equipment which may be obtained from the Bureau of Foreign and Domestic Commerce or its district and cooperative offices by referring to file No. 40,579.

A firm in Russia (No. 30,502) which is opening a branch office for the distribution of supplies for hospitals, doctors and dentists desires to purchase boiling apparatus to be used with electricity and small motors of ½ hp. and up. Correspondence may be in English.

The purchase by a manufacturer in Spain (No. 30,496) is desired of copper and brass in tubes, wire, sheets, bars, etc.; aluminum in ingots, sheets, wire, etc.; antimony, galvanized sheets, nickel, tin, tinplate, black steel sheets, steel bars. Quotations should be given c. i. f. Spanish port. Correspondence may be in English.

Trade Publications

FLOOR SCRUBBING MACHINE.—The Herr Manufacturing Company of Philadelphia is circulating a leaflet that tells about its automatic electric floor scrubbing and polishing machine.

FARM-LIGHTING PLANT.—The Superior Engineering Company, Jenkins Arcade, Pittsburgh, Pa., has issued a broadside telling about the Superior electric lighting plant for isolated dwelling use.

STEEL AND IRON CUTTING APPARATUS.—The Carbo-Hydrogen Company of America, Pittsburgh, Pa., has just issued a catalog describing the use of carbo-hydrogen apparatus for cutting steel and iron.

INDUSTRIAL LIGHTING REFLECTOR.—The Livingston industrial reflector, R. L. M. standard, is the subject of a leaflet which J. Livingston & Company, Grand Central Terminal, New York City, are distributing.

CHAIN DRIVES.—The Morse Chain Company, Ithaca, N. Y., is circulating an illustrated booklet which contains an article on chain drives by J. S. White, reprinted from the 1919 year book of the National Association of Cotton Manufacturers.

RENEWABLE FUSES.—The Chase-Shawmut Company of Newburyport, Mass., through its general sales agents, the Condit Electric Manufacturing Company of Boston, Mass., has issued catalog No. 191, descriptive of the Shawmut renewable fuses.

LAMPS FOR PHOTOGRAPHIC PROCESSES.—Illustrated bulletin No. 78-B from the Cooper Hewitt Electric Company, Eighth and Grand Streets, Hoboken, N. J., contains descriptions of many electric lamps for use in photographers' and motion-picture studios.

INDUSTRIAL LIGHTING EQUIPMENT.—The Adams-Bagnall Electric Company of Cleveland, Ohio, tells about its "Abolites" porcelain-enamel steel reflector equipment for industrial lighting in catalog No. 175, which supersedes all previous lists and catalog No. 137-B.

HANGERS FOR LIGHTING FIXTURES.—The Thompson Electric Company, 5606 Euclid Avenue, Cleveland, Ohio, is circulating a folder which tells how better results can be obtained from industrial lighting equipment through the use of its safety disconnecting hangers.

AIR WASHING AND COOLING EQUIPMENT.—The Spray Engineering Company, 93 Federal Street, Boston, Mass., has issued a sixteen-page illustrated booklet descriptive of its Spraco air washing and cooling equipment, which is especially applicable for steam-turbine generators.

FUSE SWITCH.—W. H. Matthews & Brother, Inc., St. Louis, Mo., have issued a leaflet stating the advantages of their type BF "Fuswitch."

OIL CIRCUIT BREAKER.—Bulletin No. 47,417 from the General Electric Company of Schenectady, N. Y., covers type FP-7 oil circuit breakers.

RADIO LABORATORY APPARATUS.—The General Radio Company, 11 Windsor Street, Cambridge, Mass., has issued a catalog of its radio laboratory apparatus.

OIL-BURNING MACHINES.—The Clayton & Lambert Manufacturing Company of Detroit, Mich., has just published bulletin No. 4, descriptive of its oil-burning machines.

AIR-COMPRESSOR EQUIPMENT.—Bulletin No. 1105 from the Allis-Chalmers Manufacturing Company of Milwaukee, Wis., is descriptive of its stationary and portable air-compressor equipment.

AUTOMATIC TIME SYSTEMS.—A circular entitled "Does Time Work For or Against You?" has been issued by the Stromberg Electric Company, 606 South Michigan Avenue, Chicago, Ill., and is descriptive of its automatic time system.

CONSTANT-SPEED INDUCTION MOTORS.—The Cleveland Electric Motor Company, Cleveland, Ohio is distributing a leaflet which tells about its new riveted-frame, sleeve-bearing type of constant-speed, polyphase, squirrel-cage induction motors for 25-cycle and 60-cycle operation.

GLARELESS LIGHTING UNIT.—The Duplex Lighting Works of the General Electric Company, 6 West Forty-eighth Street, New York City, has issued an illustrated booklet entitled "A New Light for the Home." Its subject is the "Duplexalite," a glareless lighting unit for home and office use.

New Incorporations

THE DELRAY (FLA.) UTILITY COMPANY has been incorporated with a capital stock of $10,000. D. K. Crater is general manager.

THE ELECTRIC UNIT CORPORATION of Huntington, W. Va., has been incorporated by C. C. Hatzell and E. F. Kincaid. The company is capitalized at $50,000.

THE ELECTRIC KEYLESS LOCK COMPANY of New York, N. Y., has been chartered with a capital stock of $10,000 by S. Greene, H. Gottesman and A. M. Bloack, Woolworth Building, New York City.

THE TWIN CITY LIGHT & POWER COMPANY of Hampton, S. C., has been incorporated with a capital stock of $30,000 by R. H. Gibson and others. The company proposes to supply electricity in Hampton and Varnville.

GILMORE M. HAYNIE & COMPANY of Evansville, Ind., have been incorporated with a capital stock of $20,000 by Gilmore Haynie, Isidor Kahn and M. S. Haynie. The company proposes to manufacture and install motor-driven power and light plants.

THE ELECTRIC ATTENDING COMPANY of New York, N. Y., has been incorporated by S. S. Celano, C. Seafidas and Eric Mazza, 2764 Broadway, New York City. The company is capitalized at $5,000 and proposes to manufacture electrical supplies.

THE SOUTHWEST GEORGIA POWER COMPANY of Bainbridge, Ga., has been incorporated by E. J. Perry, J. M. Simmons of Decatur, Ga., and Lewis B. Rump of Oglethorpe. The company is capitalized at $150,000 and proposes to build a power plant on Spring Creek.

THE SAFE-SEAL MANUFACTURING COMPANY of Hartford, Conn., has been incorporated by E. W. Putnam, 183 Oxford Street, Hartford, and E. A. Backus of Thompson, Conn. The company is capitalized at $10,000 and proposes to manufacture electric heating devices, etc.

THE PHIX LIGHT COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000 to manufacture electrical and power machinery and engines. The incorporators are T. L. Croteau, H. E. Knox and S. E. Dill of Wilmington, Del.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

ELLSWORTH, ME.—Extensions and improvements are being made to the local plant of the Bar Harbor & Union River Power Company, including the installation of a hydroelectric generating unit and a new penstock.

SQUIRREL ISLAND, ME.—Steps have been taken to organize a company to construct and operate an electric light plant in Squirrel Island. The cost is estimated at about $15,000.

CAMBRIDGE, MASS.—Work has begun on the erection of a one-story power house to be erected in connection with the new six-story manufacturing plant, 60 ft. by 140 ft., for Page & Shaw, 18 Ames Street. Considerable electrical and mechanical equipment will also be required in connection with the new building. Contract for construction of building has been awarded to the E. A. Abbott Construction Company, 3 Park Street, Cambridge.

DANVERS, MASS.—Work has begun on the erection of the transmission line for the Sand & Gravel Company of West Peabody to the Danvers municipal electric light station, which will connect it with the transmission system of the Eastern Massachusetts Electric Company. The Fred T. Ley Company of Springfield is contractor.

MALDEN, MASS.—The Malden Electric Company has closed down its electric generating plant and electricity for the local system is transmitted from the station of the Salem (Mass.) Electric Company. Many changes are being made to the local power house, including the erection of an outdoor substation and equipping the boiler plant for the use of oil instead of coal for fuel. The cost of the proposed improvements is estimated at about $75,000.

NEW BEDFORD, MASS.—Plans have been prepared by Knight C. Richmond, engineer and architect, Providence, R. I., for the erection of a large weaving mill and power house for the Beacon Manufacturing Company, to be located west of the present mill on Purchase Street.

WORCESTER, MASS.—Work will begin at once on the construction of the proposed new plant of Worcester-Walden, Inc., to be erected on Shrewsbury Street, corner of Aitchinson. The main building, 60 ft. by 333 ft., four stories, will be used for manufacturing, and another building, one story, providing 12,000 sq. ft., will house the power plant, nickel plating and hardening departments. Oil will be used for fuel.

Middle Atlantic States

BATH, N. Y.—The Lamoka Power Company has taken an option on the mill property with water rights, owned by Judd Gunderman, between this village and Kanona. The Lamoka company contemplates extensive improvements to its system.

LONG ISLAND CITY, N. Y.—A large quantity of electrical and mechanical equipment will be required in connection with the proposed new plant of the American Truck Company to be erected at Thompson, Mount and Markey Streets and Mott Avenue. The cost is estimated at more than $1,000,000.

WATERTOWN, N. Y.—The Northern New York Utilities Corporation of Watertown has petitioned the Public Service Commission for permission to erect an electric transmission line from South Edwards to Browns Falls, a distance of 12 miles, thereby connecting up its properties.

ATLANTIC CITY, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 25 for remodeling electric wiring, etc., in the United States post office at Atlantic City. For details see Searchlight Section.

LAMBERTVILLE, N. J.—Extensions and improvements are being made by the Lambertville Public Service Company, including the installation of new generating equipment at its local power plant and the erection of a new high-tension transmission line between Netcong and Newton, passing through Andover and Stanhope. Work has recently been started on the erection of a high-tension line to extend from Lambertville to Flemington.

SOUTH AMBOY, N. J.—Bids will be received by the city of South Amboy until Sept. 16 for furnishing and erecting complete mechanical equipment of artesian waterworks plant, including new buildings for housing machinery and boilers, pumping station, radial brick stack, etc.; two water-tube boilers, one duplex triple-expansion, direct-acting pumping engine, two turbine pumps, motor-driven vertical type; one single-stage air compressor, one surface condenser with combined air and circulating pump, one boiler-feed pump, feed-water heaters, steam and exhaust connections to boilers and machinery, etc. P. J. Oakley is clerk.

TRENTON, N. J.—One of the large generators at the power house of the Trenton & Mercer County Traction Company was recently damaged by fire.

TRENTON, N. J.—Arrangements have been made by the City Commission for the installation of new electrical and hydraulic apparatus at the municipal pumping station, for which an appropriation of $150,000 was made some months ago.

TRENTON, N. J.—Plans have been prepared for the construction of a new power plant and boiler house at the works of the Trenton Malleable Iron Works, New York Avenue, R. A. Schuman, 923 Lexington Street, is architect.

EASTON, PA.—The Pennsylvania Utilities Company has erected an additional power line between the Dock Street power station and the Ferry Street substation, from which all electricity is distributed.

GREENCASTLE, PA.—The establishment of a municipal electric light plant in Greencastle is under consideration by the Town Council. Plans are under way for coöperation with the borough of Waynesboro, which is also considering the construction of a municipal electric plant.

PALMERTON, PA.—Bids will be received by the Borough Council, addressed to A. C. Schaefer, secretary of Council, until Sept. 18 for installation of an ornamental lighting system consisting of ninety-one standards, with underground cable, current regulators, etc. For details see Searchlight Section.

WILKES-BARRE, PA.—Bids have been taken by the Guaranty Silk Works for the construction of power house at its plant.

ANNAPOLIS, MD.—Bids will soon be asked by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing and installing three 400-hp. water-tube boilers in the power plant at the Naval Academy. (Specification 4025.) A deposit of $10 will be required for plans.

BALTIMORE, MD.—The Anodion Metal Company, Industrial Building, Baltimore, has leased a building at 124-126 South Street, which will equip as a plant for electroplating of electric fixtures. New machinery, including motors, will be installed.

WINDING GULF, W. VA.—The Winding Gulf Colliery Company is contemplating the installation of new machinery, including boiler, generator, etc., at its power plant.

HAMPTON ROADS, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to erect an engine house, blacksmith, plumbing and machine shops at Hampton Roads, to cost about $160,000 (Specification 4027).

WASHINGTON, D. C.—Bids will be received by the chief of engineers, Procurement Branch, Equipment Section, 2729 Munitions Building, Washington, D. C., until Sept. 18, for furnishing a quantity of rubber-insulated lead-covered cable.

WASHINGTON, D. C.—Plans are under consideration by the Post Office Department for the construction of a new post office at 416 Seventh Street, S. W., complete with equipment, heating, light, water, safe, parcel post and postal savings bank equipment, etc.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until Sept. 16, Charleston, S. C., Schedule 4476—miscellaneous insulating cork. Brooklyn, N. Y., Schedule 4493—single-conductor cable. Until Sept. 19, Brooklyn, N. Y., Schedule 4489—rotary switches. Until Sept. 23, Washington, D. C., Schedule 4499—150 receiving condensers. Until Sept. 26, Annapolis, Md., Schedule 4491—300 welding electrodes and one electric welding outfit.

North Central States

MOUNT CLEMENS, MICH.—According to an announcement by Henry Ford, a branch tractor and automobile plant will be established at Mount Clemens. The proposed plant will be located on Clinton River and will cost about $500,000. The plans include the construction of a concrete dam, about 125 ft. long, to supply power for an electric plant. A special hydroelectric generator developed by the Ford engineers will be installed.

ADDYSTON, OHIO.—Contract has been awarded by the United States Cast Iron Pipe & Foundry Company of Burlington, N. J., to the Foundation Company, Pittsburgh Branch, for the construction of an addition to its local plant on River Road, to cost with equipment about $300,000.

ANSONIA, OHIO.—The city of Ansonia, it is reported, will soon ask for bids for construction of an electric light plant and waterworks system. G. L. McKibben of Van Wert is consulting engineer.

ELYRIA, OHIO.—The contract for the engineering work in connection with the extensions to the municipal waterworks system has been awarded to Morris Knowles & Company of Pittsburgh, Pa. The cost of the work is estimated at about $1,000,000, of which $350,000 will be used for a new power plant and equipment and $650,000 for pipe lines.

FREMONT, OHIO.—The plant of the Ohio State Power Company, located on the Sandusky River, 6 miles from Fremont, was recently damaged by an explosion.

MINERVA, OHIO.—Plans are being prepared by Froelich & Emery, engineers, Second National Bank Building, Toledo, for a new power house and distributing system, to cost about $50,000, for the municipal lighting system.

DAWSON SPRINGS, KY.—The contract for construction of electric light plant for the government hospital at Dawson Springs has been awarded to the Bradenburg Construction Company of Chicago, Ill.

LOUISVILLE, KY.—The Frank Fehr Ice & Cold Storage Company is planning to erect an ice-manufacturing and cold-storage plant, to cost with equipment about $500,000.

INDIANAPOLIS, IND.—Plans are under consideration by the Polar Ice & Fuel Company for doubling its manufacturing and storage capacity. Additions will be erected to three different plants in city, at a cost of about $150,000. Henry L. Dithmer is secretary of the company.

INDIANAPOLIS, IND.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 30 for alterations to mail lift and hoistway in the United States post office and court house, Indianapolis. For details see Searchlight Section.

PORTLAND, IND.—The proposal to purchase the Detamore plant, owned by the Union Traction Company of Indiana, for $18,000 has been approved by the citizens of Portland. The property will soon be taken over by the city.

CHICAGO, ILL.—The City Council is having plans prepared for the erection of an engine room and transformer station on Chicago and Michigan Avenues, to cost about $300,000.

CHICAGO, ILL.—Plans are being prepared by the Dryden Rubber Company, 1014 Kildare Avenue, Chicago, for an addition to its plant, including a new power plant. The Osborn Engineering Company, 2848 Prospect Avenue, Cleveland, Ohio, is engineer.

CHICAGO, ILL.—Revised plans have been made for the proposed plant of the Ilg Electric Ventilating Company, to be erected at Crawford Avenue and George Street, to cost about $750,000. Bids, it is understood, will soon be asked by A. S. Alschuler, architect, 28 East Jackson Boulevard, for construction of building. S. W. Weiss is president.

ELGIN, ILL.—Plans are being prepared for the installation of a municipal electric light plant, to cost about $200,000. The proposal to issue bonds for same will soon be submitted to the voters.

AMERY, WIS.—The Apple River Milling Company is contemplating the construction of a dam, power house and canal near the quarry at Colfax. C. J. Schneider is president of the company.

APPLETON, WIS.—The Wisconsin Traction, Light, Heat & Power Company is planning to erect a transmission line to Kaukauna to supply electricity for lamps and motors there. The company also contemplates completing its hydroelectric project at the Gardner Dam.

CHILTON, WIS.—Contracts have been awarded by the Aluminum Specialty Company of Manitowoc for the erection of a two-story factory, 60 ft. by 200 ft., in Chilton. A separate building for power plant and boiler house, 30 ft. by 50 ft., will also be built. Walter Spindler is president and general manager.

JANESVILLE, WIS.—Plans have been prepared by F. D. Chase, 645 North Michigan Avenue, Chicago, Ill., for construction of power house for the General Motors Company. The cost of power house is estimated at $40,000.

KELLNERSVILLE, WIS. — The High Falls Power Company is planning to extend its transmission line to Kellnersville to furnish electricity for M. Kellner & Sons Company and others in the village.

NEW LONDON, WIS.—The American Plywood Company, recently incorporated with a capital stock of $200,000, is planning to erect a new factory and power house, to cost with equipment about $150,000. Frank L. Zaug of New London is interested in the project.

PACKWAUKEE, WIS.—Plans are being prepared by Kaches & Pfaller, architects and engineers, Merchants and Manufacturers' Bank Building, Milwaukee, for the erection of a sanitarium and power plant in Packwaukee for the Creamer Memorial Institute, 200 Grand Avenue, Milwaukee. The cost is estimated at $100,000.

RIPON, WIS.—The Ripon Toy Corporation, recently incorporated, has begun work on the erection of the first unit of its plant. The company will manufacture electrical and mechanical toys. W. R. Keene is general manager

EMMONS, MINN.—Contract, it is reported, has been awarded to the Minnesota Gas & Electric Company of Albert Lea to erect a high-tension transmission line to Emmons to supply electricity for lamps and motors. The cost is estimated at $8,000.

ST. PAUL, MINN.—The Northern States Power Company has closed a contract to supply electricity for lamps and motors for the new Union Depot, the connecting load amounting to about 1500 hp. The company will also furnish steam heating service under this contract.

ELDRIDGE, IOWA.—At an election held recently the proposal to establish a municipal electric light plant in Eldridge was carried.

HEDRICK, IOWA.—The contract for installing an electric lighting system in Hedrick has been awarded to Jeffrey & Company.

INDEPENDENCE, MO.—A special election will be held Sept. 16 to submit to the voters the proposal to issue $65,000 in bonds, the proceeds to be used for extensions to the municipal electric light plant.

MOUNTAIN GROVE, MO.—The construction of a dam and power plant at Double Spring near Dora, to develop about 1000 hp., is reported to be under consideration by J. Fred Ellis and L. H. Williams.

VERSAILLES, MO.—The municipal electric light plant has been purchased by Henry Moser. Improvements will be made by the new owner and new machinery installed, to cost about $15,000.

HATTON, N. D.—Bonds to the amount of $10,500 have been voted, the proceeds to be used for extensions and improvements to the municipal electric light plant.

ANAMOOSA, N. D.—The electric plant of the Anamoosa Electric Company was recently destroyed by fire, causing a loss of about $25,000. N. J. Walper is president and manager.

MANDAN, N. D. — Plans have been completed for the installation of a new lighting system in several streets of the city.

WATERTOWN, S. D.—Plans are being prepared by Lewis C. Lawson, engineer, 18 Hendon Avenue, St. Paul, Minn., for a municipal electric light and power plant to cost about $175,000.

FAIRMONT, NEB. — Bonds to the amount of $35,000 have been authorized for the purchase of the property of the Fairmont Electric Light & Power Company.

SCRIBNER, NEB.—The town officials are considering securing electricity from the municipal electric plant at Fremont connecting with the transmission line at Hooper.

BLUE RAPIDS, KAN.—The capital stock of the Marshall County Light & Power Company has been increased from $200,000 to $500,000.

COATS, KAN.—A petition is being circulated asking the City Council to call an election to submit to the voters the proposal to issue bonds for a municipal electric light plant.

ELLSWORTH, KAN.—The installation of an ornamental street-lighting system in Ellsworth is under consideration.

ERIE, KAN.—The installation of a new electric light plant in Erie is reported to be under consideration.

HARPER, KAN.—The installation of an ornamental street-lighting system in Harper is under consideration.

SCRANTON, KAN.—An election will soon be held to submit to the voters the proposal to issue $4,000 in bonds for extensions to the municipal electric lighting system.

WILLIS, KAN.—Plans are under consideration for the installation of an electric lighting system in Willis. It is proposed to erect a high-tension transmission line from Horton to Willis to secure electricity for same.

Southern States

BLACK MOUNTAIN, N. C.—J. S. Kuykendall of Winston-Salem, it is reported, is planning to supply electricity in Black Mountain.

REIDSVILLE, GA.—An election will be held Sept. 20 to submit to the voters the proposal to issue $20,000 in bonds for the installation of a municipal electric light plant.

DAYTONA BEACH, FLA.—An electric light and power franchise, it is reported, has been granted to Nelson Mounts.

FLORENCE, ALA.—Steps have been taken to make arrangements with the Alabama Power Company of Birmingham to supply electricity for lamps and motors in Florence from its nitrate plant No. 2.

HOMESTEAD, FLA.—An election will be held Sept. 23 to submit to the voters the proposal to issue $15,000 in bonds for extensions to the municipal electric plant. It is proposed to double the output of the plant.

MIAMI, FLA.—The installation of an ornamental lighting system in the business district is under consideration. The Miami Beach Electric Company has submitted a plan for a combined street lamp and trolley pole for which the traction company agrees to share part of the expense.

CENTERVILLE, TENN.—Contracts have been awarded by the city of Centerville for the installation of a municipal electric light plant.

MOUNTAIN HOME, ARK.—Plans are under consideration for the installation of electric light and ice plants, flour and oil mills combined. J. K. Ballou, U. I. Hornbuckle and W. T. Bryant are reported interested in the project.

GUEYDAN, LA.—Contracts have been awarded by the city of Gueydan for improvements to the municipal electric light and ice plants and waterworks system, to cost about $45,000.

BRISTOW, OKLA.—The property of the Bristow Ice & Light Company has been purchased by the Sapulpa Electric Company, controlled by the Oklahoma (Okla.) Gas & Electric Company. The service will be greatly increased when the high-tension line from Sapulpa is completed, and the city pumping station and the municipal street system will be served. Beggs and Mounds will soon be connected to the transmission system of this division. Neither of these towns had heretofore had electrical service.

OKLAHOMA CITY, OKLA.—The Edison Electric Equipment Company, Baum Building, is contemplating the purchase of machinery, including an engine.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & Electric Company is planning to build at once a substation at Twenty-third Street and Ollie Avenue.

PERRY, OKLA.—Bonds to the amount of $260,000 have been voted for improvements to the municipal electric light plant and waterworks system.

CISCO, TEX.—The Humble (Tex.) Oil Company contemplates an expenditure of about $2,000,000 in connection with its Central Texas oil-lease developments, which will include the installation of an electric light and power plant, an ice plant, 10 tons daily capacity, central steam-heating plant, machine shop, administration building, garage, waterworks, 31 dwellings, etc. Evan Jones, engineer, has charge of construction work.

Pacific and Mountain States

BREMERTON, WASH.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates extensions to engine house at the Puget Sound Navy Yard to cost about $40,000 (Specification (4024).

ASTORIA, ORE.—The Pacific Power & Light Company has purchased a site, embracing 15 acres of land at Smith's Point, on which it will erect new electric power and gas plants. Contract for construction of foundation and buildings has been awarded to the Phoenix Utility Company. Orders have been placed for part of the electrical machinery. The cost of the proposed plants is estimated at about $750,000.

BANDON, ORE.—The Council is considering the question of establishing a municipal electric light plant. Mayor Topping has been selected to head a committee to investigate several sites that have been offered the city. The Bandon Power Company, which now supplies electricity for lighting the city, has been operated at a loss for some time, and it is not expected to continue operation any length of time.

SCOFIELD, ORE.—The Standard Box & Lumber Company is rebuilding its plant recently destroyed by fire. A power plant will be installed to supply electricity to operate the works. The equipment will include a 600-hp. generator and four boilers.

SAN FRANCISCO, CAL.—Plans are under consideration by the construction division, War Department, Washington, D. C., for construction of aerial defense buildings, to include three hangars, machine and engine repair shop, supply storehouse, barracks, administration building, guard house, photographic laboratory, officers' quarters and twenty cottages, to cost about $1,000,000.

COEUR D'ALENE, IDAHO.—The Home Builder Mine & Milling Company is planning to erect a nitrate plant near Coeur d'Alene Lake, the first unit to cost about $50,000. The ultimate cost of the proposed plant is placed at $500,000.

ALBUQUERQUE, N. M.—The Rio Grande Light & Power Company, Sturges Hotel Building, has engaged A. G. Hillberg, engineer, to prepare plans for a hydroelectric power plant, an auxiliary steam power plant, a large dam in White Rock Canyon 40 miles from Albuquerque on the Rio Grande River, and 140 miles of transmission lines. The cost is estimated at $4,300,000. C. G. Wilfong is president.

Canada

VANCOUVER, B. C.—Munro & Morrison of Vancouver are planning to build a sawmill near Kelly Lake, having a daily capacity of 60,000 ft. Part of the machinery will be equipped for electrical operation.

MONCTON, N. B.—The City Council has authorized J. Edington, city engineer, to secure estimates of the cost of the installation of an electric plant at the pumping station to supply electricity for the use of the city and for lighting the streets and the municipal buildings.

FOREST, ONT.—A by-law will soon be submitted to the ratepayers for the construction of a waterworks system to include electrically driven pumping equipment. James, Loudon & Hartzberg, Excelsior Life Building, Toronto, are engineers.

OTTAWA, ONT.—The Department of Naval Service is planning to erect automatic lighthouses near Fort Churchill, by which horns, sirens, lighthouses, etc., are to be electrically controlled from shore by submarine cable. The cost is estimated at about $50,000.

TORONTO, ONT.—A report is being prepared by R. C. Harris, city engineer, City Hall, for extensions to the civic electric car line and the purchase of new cars, equipment, to cost about $5,000,000.

Miscellaneous

PEARL HARBOR, HAWAII.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., in the near future, for the installation of a turbo-alternator and air compressor, condensers and auxiliary pumps, boiler-feed pump, feed-water heater, oil pumps, heater and induced-draft fan, piping and furnishing of certain electrical equipment and appurtenances in the power plant at the local naval station. (Specification, 3856.) A deposit of $10 will be required to procure plans.

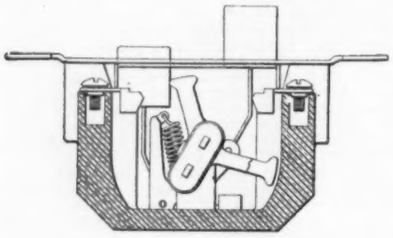
(Issued August 19, 1919)

1,313,773. ELECTRIC DROP LIGHT: Andrew A. Winter, Ocala, Fla. App. filed Dec. 29, 1917. Adjustable.

1,313,785. SUBMARINE SIGNALING APPARATUS: Charles S. Bookwalter and Freeland A. Daubin, Washington, D. C. App. filed Aug. 23, 1917. Adapted for signaling from submerged submarine.

1,313,816. ADVERTISING DEVICE: Henry K. Harris, Westminster, London, Eng. App. filed Feb. 5, 1914. Adapted to illuminated sign.

1,313,817. ADVERTISING DEVICE: Henry K. Harris, London, Eng. App. filed Dec. 19, 1914. Adopted to illuminated sign.



1,314,103—Insulating Washer

1,313,834. ELECTRIC FURNACE: Ivar Rennerfelt, Djursholm, Sweden. App. filed May 12, 1919. Vertical electrodes.

1,313,847. CONTROL FOR TAIL-LIGHTS: Howard A. Wilkinson and William B. Nixdorf, Jr., Oneida, N. Y. App. filed Dec. 14, 1917. Intensified tail-lamp control.

1,313,853. RHEOSTAT: Edward M. Bentley, Lawrence, N. Y. App. filed May 9, 1919. Adjustment gives variable effective length and resistance.

1,313,856. CIRCUIT INTERRUPTER: John F. Cavanagh, Meriden, Conn. App. filed Nov. 15, 1918. High-speed timing mechanism for internal-combustion engines.

1,313,860. ELECTRIC-WAVE-RELAYING SYSTEM: John Hays Hammond, Jr., Gloucester, Mass. App. filed June 12, 1912. Transmission of radio-telegraph and radio-telephone messages.

(Issued Aug. 26, 1919)

1,313,890. ELECTRIC FURNACE: James H. Gray, New York, N. Y. App. filed May 18, 1918. Improvements in electric furnaces of the Heroult arc type.

1,313,952. TESTING LAMP: Ferdinand Proksch, Vienna, Austria. App. filed March 18, 1916. Compact lamp test on 110, 220 or 550-volt circuits.

1,313,957. ELECTROTHERAPEUTICAL APPARATUS: Horace M. Sheeks and Fred W. Stein, Atchison, Kan. App. filed March 23, 1917. Adapted to treatment of diseases due to lack of blood circulation and insufficient nerve stimulation.

1,313,970. PROCESS FOR THE TREATMENT OF ORES AND MINERALS: George M. Willis, Chicago, Ill. App. filed Jan. 21, 1915. Ores subjected to electric current or gases, or both.

1,313,985. ELECTRIC FURNACE: John Fitzpatrick and Levi T. Stephens, Niagara Falls, N. Y. App. filed March 21, 1919. High temperature without rapid deterioration of furnace.

1,314,008. FILM SOCKET FOR SERIES LAMPS: Arthur C. McWilliams, Chicago, Ill. App. filed July 11, 1917. Means for shunting the filament of a series lamp.

1,314,050. CONNECTOR SWITCH: Harry A. Douglas, Bronson, Mich. App. filed Oct. 24, 1917. Improvement in connector switch.

1,314,081. SYNCHRONIZING APPARATUS: Ladislaw O. Kozar, Middletown, Pa. App. filed April 9, 1915. Synchronism obtained by combination of electrical and mechanical devices.

1,314,084. DIRECTION INDICATOR: William G. McMillan, Los Angeles, Cal. App. filed March 14, 1917. For use on wind shield.

1,314,095. ANTENNA ARRANGEMENT FOR WIRELESS SIGNALING OR THE LIKE: Gustav Reuther, Sayville, N. Y. App. filed May 25, 1916. Combination of antenna, frequency changer and means for changing natural frequency of circuit.

1,314,098. ELECTRIC SWITCH: Clarence C. Stirling, Hartford, Conn. App. filed Aug. 14, 1918. Improvement in pendent snap switch.

1,314,101. HIGH-FREQUENCY GENERATOR FOR TELEGRAPHY AND TELEPHONY: George von Arco and Alexander Meissner, Berlin, Germany. App. filed March 23, 1917. Special high-frequency generator.

Record of Electrical Patents

Notes on United States Patents

1,314,102. CONNECTION FOR ELECTRIC RELAYS WORKING WITH IONIZED GAS GAP: George von Arco and Alexander Meissner, Berlin, Germany. App. filed Jan. 10, 1914. Produces strengthened repeated oscillations for radio work.

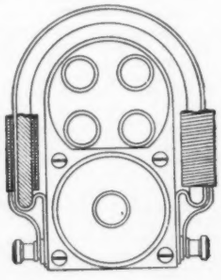
1,314,103. INSULATING WASHER: Henry Vossler, Hartford, Conn. App. filed Feb. 13, 1917. One-piece compound washer.

1,314,128. FIELD MAGNET: Albert J. Croll, Rochester, N. Y. App. filed July 20, 1918. A magnet consisting of a plurality of sections.

1,314,132. FIELD MAGNET: Farnum F. Dorsey, Rochester, N. Y. App. filed July 31, 1918. Magnet in which polar projections are connected integrally.

1,314,141. GUARD DEVICE: Frank C. Mason, Los Angeles, Cal. App. filed Aug. 29, 1917. Protection for locks of safes or vaults.

1,314,152. SPARK-GAP APPARATUS: Karl Schmidt, Stuttgart, Germany. App. filed April 25, 1918. Adapted to quenching spark gaps.



1,314,197—Magneto

1,314,166. AUTOMATIC REGULATOR: William A. Turbayne, Niagara Falls, N. Y. App. filed Dec. 31, 1912. Adapted for use with variable-speed generators in car-lighting systems.

1,314,182. BRUSH HOLDER AND CONDUCTOR TERMINAL: Walter Brown, Racine, Wis. App. filed Jan. 19, 1918. Combination holder and terminal clip of sheet metal.

1,314,197. MAGNETO: Lawrence Langner, New York, N. Y. App. filed Sept. 21, 1917. Attached electromagnetic windings for increasing intensity of magnetic flux.

1,314,208. ELECTRIC FIRE CONTROL FOR GUNS: Arthur H. Pollen, London, and Harold Isherwood, York, England. App. filed April 3, 1919. Method of operating the receiver at a gun.

1,314,214. TELEPHONE SWITCHING APPARATUS: John N. Reynolds, Greenwich, Conn., and John F. Hearn, Passaic, N. J. App. filed Jan. 8, 1918. Automatic switching mechanism for telephone exchanges.

1,314,218. ELECTRIC RECEPTACLE: Manuel R. Rodrigues, Brooklyn, N. Y. App. filed Nov. 14, 1918. Improvements in wall receptacles.

1,314,229. METHOD OF AND APPARATUS FOR PRODUCING PHOSPHORIC ACID AND COMPOUNDS OF SAME: Frank S. Washburn, Rye, N. Y. App. filed April 21, 1919. Produces phosphorus from phosphate rock, a silicious material and a carbonaceous material by means of an electric current.

1,314,250. METHOD AND MEANS FOR REPRODUCING AND AMPLIFYING WEAK, PULSATING CURRENTS: Lee de Forest, New York, N. Y. App. filed Sept. 8, 1914. For electro-responsive devices, sound-emitting means, etc.

1,314,251. RADIOTELEPHONY: Lee de Forest, New York, N. Y. App. filed March 11, 1915. Method of varying high-frequency energy and increasing the range of transmission.

1,314,252. OSCILLATION GENERATOR: Lee de Forest, New York, N. Y. App. filed May 13, 1915. Provides generator of oscillating or pulsating currents.

1,314,253. APPARATUS FOR USE IN WIRE OR RADIO COMMUNICATIONS: Lee de Forest, New York, N. Y. App. filed April 9, 1915. Detects minute changes in potential of electric currents.

1,314,259. ELECTRIC SWITCH BOX: Martin Flatland, San Francisco, Cal. App. filed March 20, 1917. Improved safety switch.

1,314,295. ELECTRIC LIGHTING APPARATUS: Charles Wirt, Philadelphia, Pa. App. filed Jan. 16, 1919. Improvement in incandescent lamp socket.

1,314,302. QUICK-BREAK SWITCH: Harry M. Broadwell, Plainville, Conn. App. filed Aug. 22, 1918. Helical switch-throwing springs for knife-blade switch.

1,314,305. TRANSFORMER: Robert A. Conner, Chicago, Ill. App. filed June 28, 1915. Means for insulating the primary and secondary winding from each other.

1,314,311. ELECTRIC WAVE TRANSMISSION: Cornelius D. Ehret, Philadelphia, Pa. App. filed Feb. 1, 1918. Electric signaling system by means of high-frequency current.

1,314,324. ATTACHMENT FOR WATER OR FLUID HEATERS WITH FAUCETS: Nickolas Gerson, Philadelphia, Pa. App. filed March 17, 1919. Electrical device for water faucet.

1,314,332. ELECTRICAL SAFETY DEVICE: Ora O. Jones, Chicago, Ill. App. filed Jan. 12, 1918. Operates circuit breaker in alternating-current circuit in case of break in any phase.

1,314,339. ELECTRIC SIGNAL SYSTEM: William E. Laidley, Cleveland, Ohio. App. filed June 2, 1916. Simplifies electric alarm system by eliminating special wiring circuits.

1,314,346. OUTLET-BOX FITTING: William F. Meschenmoser, New York, N. Y. App. filed July 8, 1915. Outlet box fitted with plug receptacle.

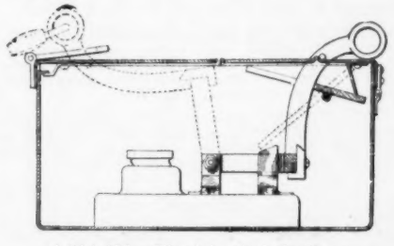
1,314,372. CONDUIT OUTLET BOX: Elda G. Smith, Syracuse, N. Y. App. filed July 13, 1917. Applicable to controller box of railway cars.

1,314,373. REACTANCE COIL: Severn D. Sprong, Brooklyn, N. Y. App. filed March 2, 1918. A balanced three-phase reactance.

1,314,384. ART OF MANUFACTURING STEEL: George W. Benjamin, New York, N. Y. App. filed Dec. 5, 1914. Improvement in electric melting furnaces.

1,314,388. LOCKING MEANS FOR INCANDESCENT LAMPS: Luther F. Cole, Sacramento, Cal. App. filed June 24, 1918. Combination with lamp and socket of means for locking lamp.

1,314,427. RECORDING TIME LOCK: Edwin S. Phelps, Elizabeth, N. J. App. filed June 9, 1915. Remote-controlled recording mechanism.



1,314,259—Electric Switch Box

1,314,447. KEROSENE VAPORIZER FOR MOTOR CARS: Le Roy Werts, Mulford, Mo. App. filed Feb. 12, 1918. Generator and storage battery used with resistance coil to vaporize kerosene.

1,314,453. TELEPHONE SYSTEM: George A. Yanochouski, Chicago, Ill., and Harry E. Hershey, White Water, Kan. App. filed Aug. 21, 1918. Operates measured service devices or supervisory signals in an automatic or semi-automatic system.

1,314,454. REPEATER FOR AUTOMATIC TELEPHONE SYSTEMS: Talbot G. Martin, Chicago, Ill. App. filed Feb. 9, 1916. Automatic switches for establishing connections with systems comprising plurality of exchanges.

1,314,455. AUTOMATIC TELEPHONE SYSTEM: John Wicks, Columbus, Ohio. App. filed Feb. 23, 1916. Automatic calling over serially related long-distance lines.